WHO/EOS/98.6
DISTR: GENERAL
ORIGINAL: ENGLISH

TEACHER'S GUIDE

Management of wastes from health-care activities

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This *Teacher's Guide* accompanies the WHO publication *Management of wastes from health-care activities* (Geneva, 1999). It provides teaching materials and recommendations for a three day training course, designed mainly for managers of health-care establishments, public health professionals and policy makers.

Note to the user: A selection of photographs is available from the Web site of the World Health Organization (after October 1998, http://www.who.ch/)

World Health Organization
Geneva, 1998

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Preface

This *Teacher's Guide* compiles educational materials that can be used in training courses for health-care waste management. It is a compendium to the WHO publication *Management of wastes from health-care activities* (WHO, Geneva, 1999), which is a more comprehensive handbook. Both publications form a "set", which can be useful to handle this important public health issue in a practical manner. These are the first WHO publications providing global advice and guidance on the management of health-care waste. They build on the knowledge and experience gained in different WHO regions over the past years.

Management of health-care waste is an important public health issue since it involves major risks for the health of the people and the environment. WHO is, therefore, issuing this set of materials to provide operational tools for health care workers, environmental professionals, public health authorities, manufacturers of health care products as well as policy makers. This training guide compiles basic information on health-care waste, management principles, and provides tools for training using appropriate educational materials such as overhead transparencies, handouts, tables and figures.

The Health-care waste management set (Handbook + Teacher's Guide) aims to raise awareness on public health and environment, to provide information on sound management practices of health-care waste, to identify safe, efficient, sustainable, economic and culturally acceptable waste management practices and to enable managers of health-care establishments to develop their waste management plans.

This *Teacher's Guide* has been prepared as a practical response to the need for improved health-care waste management at local level and improved legislation, management and guidance at national and regional level. WHO will be pleased to see that this guide is used widely. Continuing efforts will be made to improve its content and structure. It would be appreciated if the users of this guide would provide feedback from its use and their own experiences. Please send us your comments and suggestions on the WHO *Teacher's Guide* on health-care waste management direct to the Division of Operational Support in Environmental Health, World Health Organization, Geneva, Switzerland (Fax: +41 22-791 4127, e-mail: pruessa@who.ch).

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Acknowledgements

The World Health Organization thanks all individuals who have contributed to the preparation of the handbook *Management of wastes from health-care activities* (WHO, Geneva, 1999) that served as a basis for the production of this *Teacher's Guide*. Contributers and reviewers are listed in the 'Acknowledgements' section of the handbook.

1. Introduction

1.1 Purpose of the *Teacher's Guide*

The *Teacher's Guide* complements the WHO publication *Management of wastes from health-care activities* (Geneva, 1999). It can be used to assist in the preparation and delivery of a three day course, adapted to provide a one day introductory course, or expanded to five days to include technical visits. There is sufficient resource material to initiate, organize, deliver and evaluate courses of different lengths. The course material includes overhead transparencies, handouts showing definitions, tables and figures and the material necessary for workshops.

The *Teacher's Guide* has been prepared to allow the course to be given without further development on background information on health-care waste, management principles, training etc. In order to increase the benefit for the course participants, it is strongly advised to include local issues in the programme. The course coordinator should plan the collection of material on the local situation (practices, legal framework, disposal possibilities, cultural issues, practical examples), preferably illustrated by photographs, figures and objects. The coordinator may also invite guests or course participants to prepare certain topics which they may present during the course (e.g. officers in national authorities may present legal framework or current policy; hospital managers may present practices in their establishment etc.). In this case, presenters should be contacted well in advance and agree to their presentation.

1.2 How to use the *Teacher's Guide*

The *Guide* provides material for a tutor to arrange a course and includes information to assist in organizing workshops.

The *Guide* should be read by the course tutor well before the beginning of the course and the tutor should allow sufficient time for the preparation of local examples to illustrate points discussed.

Extensive use is made of overhead projection as a visual aid, however, if a projector is not available the content of the slides can be copied onto flip charts or blackboards.

1.3 Target groups for the course on HCW

The course designed in this *Teacher's Guide* is targeted at managers, regulators and policy makers which are involved in health-care waste management. The main professional categories are the following:

Officials from national or regional authorities involved with developing policies in health-care waste management;
Environmental or health and safety regulators;

Environmental health professionals;
Hospital managers and other administrators of health-care establishments;
Representatives of local authorities;
Waste collection, treatment and disposal managers;
Manufacturers of medical devices, chemicals and pharmaceuticals.

1.4 The objectives of the course on HCW

The course tutor should set out the learning objectives in the opening lecture of the course. This statement will make clear what is to be achieved by the end of the course. It is likely that the backgrounds, functions and level of knowledge of the participants will vary. Accordingly, the objectives of the course should be adapted. The main objectives are the following:

To raise awareness on public health and environment hazards that may be associated with inappropriate segregation, storage, collection, transport, handling, treatment and disposal of health-care waste;

To provide information on hazards and sound management practices of health-care waste for the formulation of policies and the development or improvement of legislation and technical guidelines;

To identify waste management practices and technologies that are safe, efficient, sustainable, economic and culturally acceptable; to enable the participants to identify the systems suitable for their particular circumstances;

To enable managers of health-care establishments **to develop their waste management plans**;

To enable course participants to develop training programmes for the different categories of staff that handle, treat or dispose of health-care waste.

At the end of the course the participants should be able to demonstrate individually that they have achieved the course objectives and competence in health-care waste management.

2. Teaching and training in health-care waste management

2.1 Rationale for training in health-care waste management

Health-care waste is special in that it has a higher potential of infection and injury than any other type of waste. Therefore, it has to be handled with sound and safe methods wherever generated. Inadequate handling of health-care waste may have serious public health consequences and impact on the environment. Health-care waste management is, therefore, an important and necessary component of environmental health protection.

Hospitals and health-care establishments have responsibilities and a "duty of care" for the environment and public health, particularly in relation to the waste they produce. They also carry a responsibility to ensure that there are no adverse health and environmental consequences as a result of waste handling, treatment and disposal activities. Unfortunately, health-care waste management is, in many regions, not yet carried out with a satisfactory degree of safety. This course aims at transmitting the basic skills for the development and implementation of a health-care waste management policy, including the components outlined in this programme. In this way, health-care and research facilities can take steps towards securing a healthy and safe environment for their employees and communities.

2.2 The HCW course programme

The proposed programme for a three day course is shown in Table 1. Should the course be expanded or condensed, then the course programme should be adjusted to meet the objectives set out in 1.4. The programme should not be too ambitious or impracticable but be designed to make the objectives easily achieved. According to the participant's interests and level of knowledge, certain parts of this course may be condensed and others expanded.

The last ten minutes of each lecture should always be dedicated to questions by the participants. Should the lecturer finish his presentation before, she/he may foster a discussion with the participants on how the presented aspects relate to their local situation.

Table 1: Proposed time-table for a three day course

	Day 1	Day 2	Day 3
45 min	Introduction	Minimization, recycling and segregation Lecture 5	Wastewater management Lecture 10
45 min	Definition of health-care waste; hazards and public health impacts of health-care waste Lecture 1	Handling, storage and transportation Lecture 6	Worker's health and safety and emergencies Lecture 11
	Break		
45 min	Introduction to legislation Lecture 2	Minimization, segregation and handling options Workshop 3	Waste management related costs Lecture 12
45 min	Current national and local legislation Workshop 1	Treatment and disposal options (i) Lecture 7	Training Lecture 13
	Lunch break		
45 min	National programme for HCW management Lecture 3	Treatment and disposal options (II) Lecture 8	Options: (a) Regulatory package (b) Waste management plan - design Workshop 5
45 min	HCW management programme for a health-care establishment Lecture 4	Application of treatment and disposal methods to health-care waste categories Lecture 9	
	Break		
90 min	HCW management plan a) Action plan for implementation of national HCW management b) How to improve HCW management plan of the health-care establishment Workshop 2	Treatment and disposal options policy considerations major urban hospitals smaller or remote establishments Workshop 4	Workshop 5 (continued) Results of the workshop Evaluation of the course Final discussions and closure

2.3 Planning the HCW course

It is essential that there is one course coordinator, who takes on the responsibility for planning and delivering the course. Sufficient time should be given to these activities.

The course coordinator's role is crucial in ensuring the course has the right pace and that all of the activities are kept to the time allocated. The coordinator must ensure that the lecturing and teaching staff are properly briefed and the necessary resources are available on site and on time.

2.4 The problem solving approach to learning

The hazards relating to health-care waste, the regulatory issues and the operational practices will be presented through formal teaching and illustrated by visual aids. If the students apply health-care waste management principles to their own tasks and guidance, and supervision ensures that this is done correctly, the learning will be detailed and long lasting.

The problems that the students deal with in a course setting should be of increasing complexity and they should be encouraged to use appropriate resource materials. A first step in problem solving is to encourage students to answer questions based upon local problems during the lectures. Secondly, during the workshop settings, a scenario should be developed which will be based directly on material that has already been presented formally, structured questions will then be asked, which will lead to a particular solution. Thirdly they should be required to tackle real issues, preferably local in origin where the students develop the questions to be asked, seek the information required and find a solution themselves. This is the most complex situation and the students will require assistance from the tutors.

2.5 Formal presentations

Through giving lectures or presentations, one person can inform a large number of course participants of the content of the course and the principles of the subject. This enables new ideas to be introduced, particularly information on the national and local situation which is not readily available in text books or other published material. Although the audience will have a limited attention span, by proper planning the effects of this can be minimized.

Lectures are an important way of disseminating information. A well prepared lecture can be an extremely satisfying experience and a very efficient means of teaching. Thorough preparation is essential and the lecturer must be confident and have a thorough knowledge in the subject, particularly when the opportunity is given for a question and answer session at the end of the lecture. However, instant answers are not always possible. Should the lecturer be unable to answer, every effort should be made to find the answer as soon as possible or advise where the answer may be found.

At the end of each lecture, an interactive discussion between presenter and participants to address questions or applicability to the participant's situation is recommended.

During the workshop sessions, small group discussions led by the lecturer or an assistant can be an effective method of learning. It widens the knowledge base and reinforces the information given in lectures.

Recommendations for effective communication of the lecture content to the participants are given below:

Useful hints for effective presentations

Face participants at all times

Maintain eye contact

Speak clearly and at a moderate speed

Pause for a few seconds at the end of making a point

Leave each overhead slide on the screen for sufficient time to allow the participants to make notes (distribute reduced overheads before the presentation)

Engage in interactive question and answer style

2.6 Audiovisual and other teaching aids

This Guide proposes to use visual aids to accompany the lectures and workshops. The overheads shown in this Guide may be copied directly onto transparent plastic sheets and used with overhead projectors. Overhead transparencies can be produced with many photocopying machines. The use of a bright projector that does not require a darkened room is best. Overhead projectors are readily portable and not as expensive as slide projectors.

The overheads could also be produced as 35mm slides. Slide projectors however may be less reliable than overhead projectors and require a darkened room. They can be helpful to illustrate practical situations with photographs of plants, equipment and personnel.

Technology is now available for making presentations with a portable computer using a special projector. This equipment is expensive and may not be readily available in some countries, but is a convenient and may be considered. However, careful planning is required for its use.

In some situations, videotaped material may also prove to be a good means of presenting information and encouraging discussion. Again the necessary equipment is expensive and requires professional maintenance. Producing video material is time-consuming, difficult and if carried out professionally it is expensive.

All presentations should be prepared well in advance of the course to avoid loss of time or distraction from the objectives of the presentation.

This guide does not contain photographs. A selection of photographs on diverse aspects and applications of health-care waste management should be available on the Web site of the World Health Organization's Programme of Environmental Health (after October 1998, http://www.who.ch/). From there they could be printed directly onto transparent sheets and projected with an overhead projector. They would provide valuable illustrations of management practices and show practical examples.

2.7 Evaluation

Evaluation aims at assessing the extent to which the course objectives have been attained and at determining the quality of the teaching. The evaluation results will allow the course to be improved or adapted as necessary for future use. An evaluation of the course can be made by carrying out a short initial assessment of the level of knowledge of the participants right at the beginning of the course and by comparing it to the knowledge assessed at the end of the course. A questionnaire for the initial assessment is proposed in Chapter 3.1, Introduction - resources. The same questionnaire may be completed by the participants at the end of the course and the initial and final results compared. Also, the participants should be consulted on the content, visual aids and teaching methods at the end of the course. This can be carried out by asking them to complete an anonymous written questionnaire. An example is shown in Table 2. The results could then be analysed by the organisers.

The teachers may also wish to carry out an assessment using *Self assessment for teachers of Health* by A. Rotem and F. Abatt (World Health Organization, Geneva, 1982, WHO Offset Publication No. 68), which is a good source of advice. It illustrates the teaching skills that can be developed and indicates ways of improving those skills.

Evaluation of the course and the teachers by the participants is as important as assessing the competence of the participants at the end of the course.

Table 2: Course evaluation form for participants

It is through your comments that we can improve this course and maintain a high standard in the future. We would greatly value your help by completing this questionnaire. This evaluation is anonymous, only mark your name if you wish**Thank you**.

Please underline your answer

1. Did this course help to improve your knowledge on the subject and fulfil your expectations? Yes/No

Comments

2. Were any topics omitted from the programme that you felt should have been included?

If so state what they are:

3. Did you feel that the course level was appropriate for you? Too high/adequate/too low

4. Was the course too theoretical? yes/no

5. Was the ratio lecture/workshops & discussionsadequate? yes/no

Comments

6. Do you feel that another related course should be held (yes/no)? If yes who do think should attend?

7. Did this course provide you with the necessary elements and confidence to contribute to improvement of health-care waste management practices in your country/ region/ establishment? yes/no

Comments

8. Please indicate your ratings for the following:

Method of presentation (Use of audio visual equipment)	Very Good/Good/Fair/Poor
Documentation	Very Good/Good/Fair/Poor
Location and facilities	Very Good/Good/Fair/PoorTable 2 (continued)

Please evaluate the Lectures and Workshops using the following scale

5 = Excellent 4 = Good 3 = Average 2 = Fair 1 = Poor

Activity	Presentation	Content
Lecture 1 - Definitions, hazards, risks.		
Lecture 2 - Legislation		
Workshop 1 - Current national and local laws		
Lecture 3 - National programme		
Lecture 4 - Health-care establishmentprogramme		
Workshop 2 - Waste management plan		
Lecture 5 - Minimization, recycling, segregation		
Lecture 6 - Handling, storage and transport		
Workshop 3-Minimization, recycling, segregation		
Lecture 7 - Treatment and disposal (I)		
Lecture 8 - Treatment and disposal (II)		
Lecture 9 - Application to waste categories		
Workshop 4 - Treatment and Disposal Options		
Lecture 10 - Wastewater management		
Lecture 11 - Worker's health and safety		
Lecture 12 - Related costs		
Lecture 13 - Training		
Workshop 5 - Regulatory package/ Management plan		
The course overall		

Comments

3. Course resources

This section of the *Teacher's Guide* contains a variety of resource materials which the teachers may use for their presentations. It includes:

Overheads (to be copied onto transparent sheets)
Teacher's notes referring to the overheads
Reduced overheads as handouts
Handouts containing background information
Handouts with tasks/questions for the workshops

The teacher may complete certain lectures with additional overheads, handouts or other material, in particular to add information of local relevance, practical examples and case studies. The course coordinator may also contact certain participants before the course and ask them to prepare a case study on their own situation, to present during the course.

The overheads are generally for the teachers and the handouts for the participants. They may, however, be converted into handouts/overheads as appropriate. The overhead content may also be copied onto a blackboard.

The references of the material presented in this *Teacher's Guide* are stated in the publication *Management of wastes from health-care activities* (WHO, Geneva, 1999).

3.1 Introduction - resources

In the Introduction, the following issues should be addressed:

rationale for this course;
context of the course (e.g. if part of a more comprehensive programme);
course objectives (Overhead 1.1);
invitation of participants to shortly introduce themselves and their professional activity;
brief assessment of the level of knowledge on health-care waste (HCW) management of the participants (example of assessment sheet in Table 1.1, to be completed in about 10 minutes);
short background on health-care waste management (see Teacher's notes - Introduction);
local situation of health-care waste management (see Teacher's notes - Introduction).

Overheads

Overhead 0.1	Learning objectives
Overhead 0.2	Actors in health-care waste management

Teacher's notes

Handouts

Initial Assessment
Reduced overheads

Overhead 0.1

Course Objectives

- Raise awareness on hazards related to HCW management
- Provide information on good HCW management practices
- Foster the development of policy and legal framework
- Identify suitable HCW management practices for local situations
- Enable development of local waste management plans
- Enable development of training courses

Overhead 0.2

Actors in HCWM

- Managers of health-care establishments
- Medical staff
- Nursing staff
- Auxiliary staff
- Cleaners
- Laboratory staff
- Technical Staff

- Policy makers
- Health Ministry
- Environment Ministry
- Local authorities
- Waste managers
- Waste collectors
- Waste treatment and disposal staff
- Scavengers

•etc.

Teacher's notes - Introduction

Brief introduction to the problematique of health-care waste management

Health-care waste is special in that it has a higher potential for infection and injury than other types of waste;
Inadequate handling of health-care waste may have serious public health consequences and impact on the environment;
Health-care waste management is therefore a necessary component of environmental health protection;

Requirements for improved health-care waste management

Improved health-care waste management requires awareness raising; a legal framework and a policy, which have to be implemented locally; waste management plans for health-care establishments; staff training;

Actors in health-care waste management

See Overhead 0.2.

Local circumstances

The teacher should describe the local circumstances of health-care waste management of the regions or countries by which the participants are concerned; participants can be solicited to describe their situation;

Overhead 0.1

Course objectives may differ according to background, professional activities and demands of the participants. All objectives listed on the slide may not be applicable to all participants.
The participants should be given sufficient information to develop or improve their own policy/ legal framework/ waste management plan etc. The course should provide a basis for further actions to be taken at national/ local authority or health-care establishment level to improve management practices.
(Course objectives may be discussed with the participants).

Overhead 0.2

The actors involved in HCW management are numerous and are situated at different levels (authorities, waste producers, waste handlers);
Health-care and maintenance personnel of health-care establishments;
Patients in health-careestablishments;
Visitors in health-care establishments;
Workers in support services to health-care establishments, such as laundries, waste handling and transportation;
Workers in waste disposal and treatment facilities, including scavengers;

Individual generators outside establishments (drug abusers, patients under home care (including home dialysis);
Officials of national or local authorities involved in forming policy, preparing legislation and law enforcement.

Initial Assessment

Please briefly answer the following questions:

1. What are the wastes produced in health-care? (make a short list with explanations)

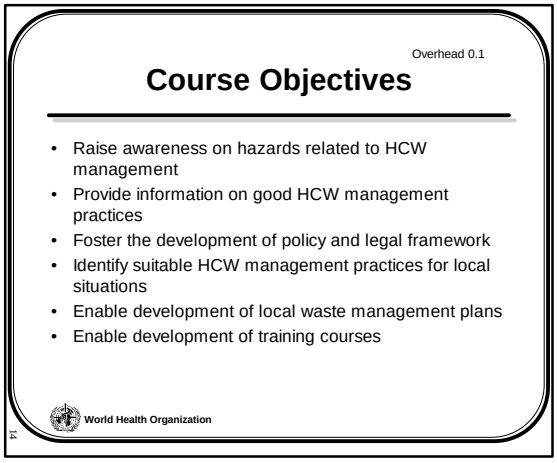
2. What are the risks to human health if health-care wastes are not managed properly?

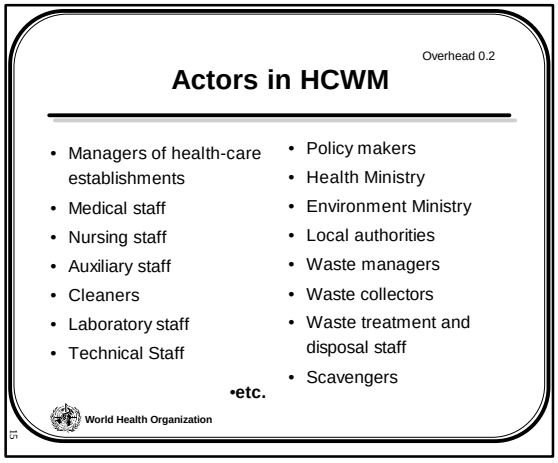
3. Which are the main points of health-care waste management that could be improved in your country/ health-care establishment?

4. Make suggestions on how improved health-care waste management could be achieved in your circumstances?

5. Do you know what laws and regulations apply to waste and health-care waste in your country? If so, please make a list and describe their content.

Reduced overheads - Introduction





3.2 Lecture 1
Definition of HCW, hazards and public health impact

Overheads

Overhead 1.1	Definitions
Overhead 1.2	Health-care activities
Overhead 1.3	Hazardous health-care waste
Overhead 1.4	Major sources of health-care waste
Overhead 1.5	Minor sources of health-care waste
Overhead 1.6	HCW generation by region
Overhead 1.7	What is risk?
Overhead 1.8	Hazardous properties of HCW
Overhead 1.9	Hazardous properties of chemicals
Overhead 1.10	Who is at risk?
Overhead 1.11	Public health risks of hazardous HCW
Overhead 1.12	Public sensitivity

Teacher=s notes

Handouts

Handout 1.1	Categories of hazardous health-care waste
Handout 1.2	A selection of infections from exposure to health-care wastes, agents and transmission pathways
Handout 1.3	Occupational transmission of HIV in the USA and in France
Handout 1.4	Spreading of nosocomial infections

Reduced overheads

Definitions

Health-care waste

Total waste stream from HCW generators
(major and scattered sources)

Hazardous health-care waste

75 - 90% of general waste (similar to domestic waste)
10 - 25% is hazardous (infectious, toxic etc.)

Overhead 1.2

Health-care activities

Health-care activities (for humans) generating waste include:

- Diagnosis
- Treatment
- Prevention of diseases
- Alleviation of disablement
- Associated research

Overhead 1.3

Hazardous health-care waste

- Infectious
- Pathological
- Sharps
- Pharmaceutical
- Genotoxic
- Chemical
- Heavy metals
- Pressurized containers
- Radioactive

Overhead 1.4

Major sources of health-care waste

- Hospitals
- Clinics
- Laboratories
- Research centres
- Animal Research
- Bloodbanks
- Nursing Homes
- Mortuaries
- Autopsy centres

Overhead 1.5

Minor sources of health-care waste

- Physician's office
- Dental clinics
- Home health-care
- Nursing homes
- Acupuncturists
- Psychiatric clinics
- Cosmetic piercing and tattooing
- Funeral services
- Paramedic services
- Institutions for disabled persons

HCW Generation by Region

Region	kg/bed/day
• North America	7 - 10
• Latin America	3
• Western Europe	3 - 6
• Eastern Europe	1.4 - 2
• Middle East	1.3 - 3
• East Asia High Income	2.5 - 4
• East Asia Middle Income	1.8 - 2.2

What is Risk ?

the probability that the hazard
of a substance will cause harm
and the severity of that harm

Hazardous properties of HCW

Hazardous HCW may have the following properties:

- contains infectious agents
- genotoxic
- contains hazardous chemicals or pharmaceuticals
- radioactive
- contains sharps

Hazardous properties of chemicals

- Toxic
- Corrosive
- Flammable
- Reactive
- Explosive
- Shock sensitive
- Genotoxic

Who is at Risk ?

- Doctors and nurses
- Patients
- Hospital support staff
- Waste collection and disposal staff
- General public

Public health risks of hazardous HCW

Potential health effects:

- AIDS
- Hepatitis B and C
- Gastroenteric infections
- Respiratory infections
- Blood stream infections
- Skin infections
- Effects of radioactive substances
- Intoxication

Overhead 1.12

Public sensitivity

Public sensitivity

- about incidents involving HCW
- about visual impact of HCW

Cultural practices should be taken into account in HCW management.

Teacher-s notes - Lecture 1

Overhead 1.1

Health-care waste is defined as the total waste stream (solid and liquid) from health-care establishments, research facilities and laboratories. In addition, health-care activities in minor or scattered sources, including health-care provided at home, may also generate health-care waste. 75% to 90% of the waste of health-care providers is general waste, comparable to domestic waste, and mostly comes from the administrative and housekeeping function of the establishments. This general health-care waste may also include waste from the maintenance of the premises of a health-care facility. The remaining 10% to 25% are hazardous health-care wastes which may create a variety of health risks. In this course, only hazardous health-care waste will be considered. General wastes should join the municipal waste stream.

Overhead 1.2

This will also include some veterinary waste and dead animals arising in research and public health laboratories.

Overhead 1.3

Distribute Handout 1.1: Categories of hazardous health-care waste
The Table sets out the categories of health-care waste. These categories will be considered all throughout the course.

Overhead 1.4

Hospitals
University hospital, General hospital, District hospital

Other health-care establishments
Emergency medical care services, health-care centres and dispensaries
Obstetrical and maternity clinics, out-patients clinics, dialysis centres
First aid posts and sick bays, long-term health care establishments and hospices, transfusion centres, military medical services

Related laboratories and research centres
Medical and biomedical laboratories, biotechnology laboratories and institutions, medical research centres

Mortuary and autopsy centres, Animal research and testing, Blood banks and blood collection services, Old-age nursing homes

Overhead 1.5

They will rarely produce:
a) Radioactive or cytotoxic waste although in high income countries this is on the increase;
b) Human body parts;
Sharps will be mainly syringe needles.

Overhead 1.6

Health-care waste generation differs not only from country to country, but also within a country. Waste generation depends on numerous factors such as waste management methods, type of health-care establishment,specializations of the hospital, ratio of reusable items in use, ratio of day care etc. It is therefore suggested that these data only be used as examples, and not as a basis for waste management within an individual health-care establishment. Even a limited survey will probably provide more reliable data on local waste generation than any estimation based on data from other countries or types of establishments.

Overhead 1.8

Pathogens may infect the human body through the following pathways:
- absorption through an opening or cut in the skin
- absorption through the mucous membranes
- inhalation
- ingestion

Sharps may not only cause cuts and punctures, but also infect the wounds by agents which previously contaminated sharps.
Genotoxic is the property of a substance or its metabolite that is capable of interacting directly with DNA (genetic material), leading to DNA damage that can be assayed. It may include carcinogenic, mutagenic or teratogenic substances.

Overhead 1.9

These are the properties that hazardous chemicals may have. Fractions of these will be found in HCW after their use or when they are no longer required. They may cause intoxications, injuries or burns. Intoxications can arise from absorption through the skin or mucous membranes and from inhalation or ingestion.

Overhead 1.10

All persons exposed to hazardous health-care waste are potentially at risk. That is why a tightly controlled management system is required.
The main groups at risk are the following:
- Nurses, auxiliaries, and hospital maintenance personnel;
- Patients in health-care establishments or under home care;
- Visitors in health-care establishments;

- Workers in support services to health-care establishments, such as laundries, waste handling and transportation;
- Workers in waste disposal facilities (such as landfills or incinerators), including scavengers.

Overhead 1.11

Potential health effects from exposure to health-care waste are numerous. Infections may be transmitted by contact to patient=s excretions or body fluids contained in the waste. Pathogens may also be distributed by rodents and insects that come in contact with unsafely stored waste.
Little data exist on the number of infections caused by exposure to infectious waste.
Poor management of HCW is also suspected to contribute to nosocomial (or hospital-acquired) infections. There is potential risk of nosocomial infections when the waste contaminates patients or surfaces. This may happen if the waste is not well packaged, stored or handled. Therefore there are strong links between health-care waste management and hospital hygiene. A selection of possible infections that could be caused by exposure to health-care waste is provided in Handout 1.2. Handout 1.4 illustrates the spreading of nosocomial diseases in a very summarized way. In the upper part of the handout are listed the possible sources of pathogens, which includes waste. The middle part contains possible routes of transmission and examples of diseases which may be acquired in a health-care establishment.

Overhead 1.12

The general public is usually very sensitive about incidents involving health-care waste.
Also, in no culture it is acceptable to dump anatomic waste (recognizable anatomic parts from the human body) on a landfill.
In some cultures, especially in Asia, religious beliefs require that human body parts be turned back to the patient=s family in little coffins, to be buried in cemeteries.

Handout 1.1

Categories of hazardous health-care waste

Waste category	Description and examples
Infectious waste	Waste suspected of containing pathogens *e.g. laboratory cultures, waste from isolation wards, tissues, materials or equipment having been in contact with infected patients, excreta*
Pathological waste	Human tissue or fluids *e.g. body parts, blood and other body fluids, human foetuses*
Sharps	Sharps waste *e.g. needles, infusion sets, scalpels, knives, blades, broken glass*
Pharmaceutical waste	Waste containing pharmaceuticals *e.g. pharmaceuticals which are expired or no longer needed, items contaminated or containing pharmaceuticals (bottles, boxes)*
Genotoxic waste	Waste containing substances withgenotoxic properties *e.g. waste containing cytotoxic drugs (often used in cancer therapy), genotoxic chemicals*
Chemical waste	Waste containing discarded chemical substances *e.g. laboratory reagents, film developer, disinfectants which are expired or no longer needed, solvents*
Wastes with high content of heavy metals	e.g batteries, broken thermometers, blood pressure gauges
Pressurized containers	Gas cylinders, cartridges and aerosol cans
Radioactive waste	Waste containing radioactive substances *e.g. unused liquids from radiotherapy or laboratory research, contaminated glassware, packages or absorbent paper, urine and excreta from patients treated or tested with unsealed radionuclides, sealed sources*

Handout 1.2

A selection of infections from exposure to health-care wastes, agents and transmission pathways

Pathology	Examples of associated pathogens	Infected body fluids
Gastroenteric infections	Enterobacteria, e.g. *Salmonella, Shigella spp.* *Vibrio cholerae*, Helminths	Faeces and/or vomiting
Respiratory infections	*Mycobacter tubercul.*, Measles virus, *Strept. pneumoniae*	Breathing secretions, saliva
Ocular infection	Herpesvirus	Eye secretions
Genital infections	*Neisseria gonorrhoeae*	Genital secretions
Skin infections	*Streptococcus* spp.	Pus
Anthrax	*Bacillus anthracis*	Skin secretions
Meningitis	*Neisseria meningitidis*	Cerebrospinal fluid
AIDS	Human immunodeficiency virus (HIV)	Blood, sexual secretion
Haemorrhagic fevers	Junin, Lhassa, Ebola and Marburg viruses	All bloody products and secretions
Septicaemia	*Staphylococcus* spp.	Blood
Bacteraemia	Coagulase-negative staphylococci, *Staphylococcus aureus, Enterobacter, Enterococcus*	Blood
Candidaemia	*Candida albicans*	Blood
Hepatitis A	Hepatitis A virus	Faeces
Hepatitis B & C	Hepatitis B and C viruses	Blood and body fluids

Questions

1) How are the hospital acquired infections dealt with and controlled in your country/ establishment?

2) How do you think that they are transmitted?

3) What measures would you take to control them?

4) To what extent do you think that health-care waste contributes to the spread of nosocomial infections ?

5) How would you prepare and carry out a programme to raise awareness amongst the staff of the dangers and the measures to combat these problems?

Handout 1.3

Occupational transmission of HIV in the USA and in France

USA:
In June 1994, 39 cases of HIV infections were recognized by the Centre for Disease Control as occupational infections, with the following pathways of transmission:

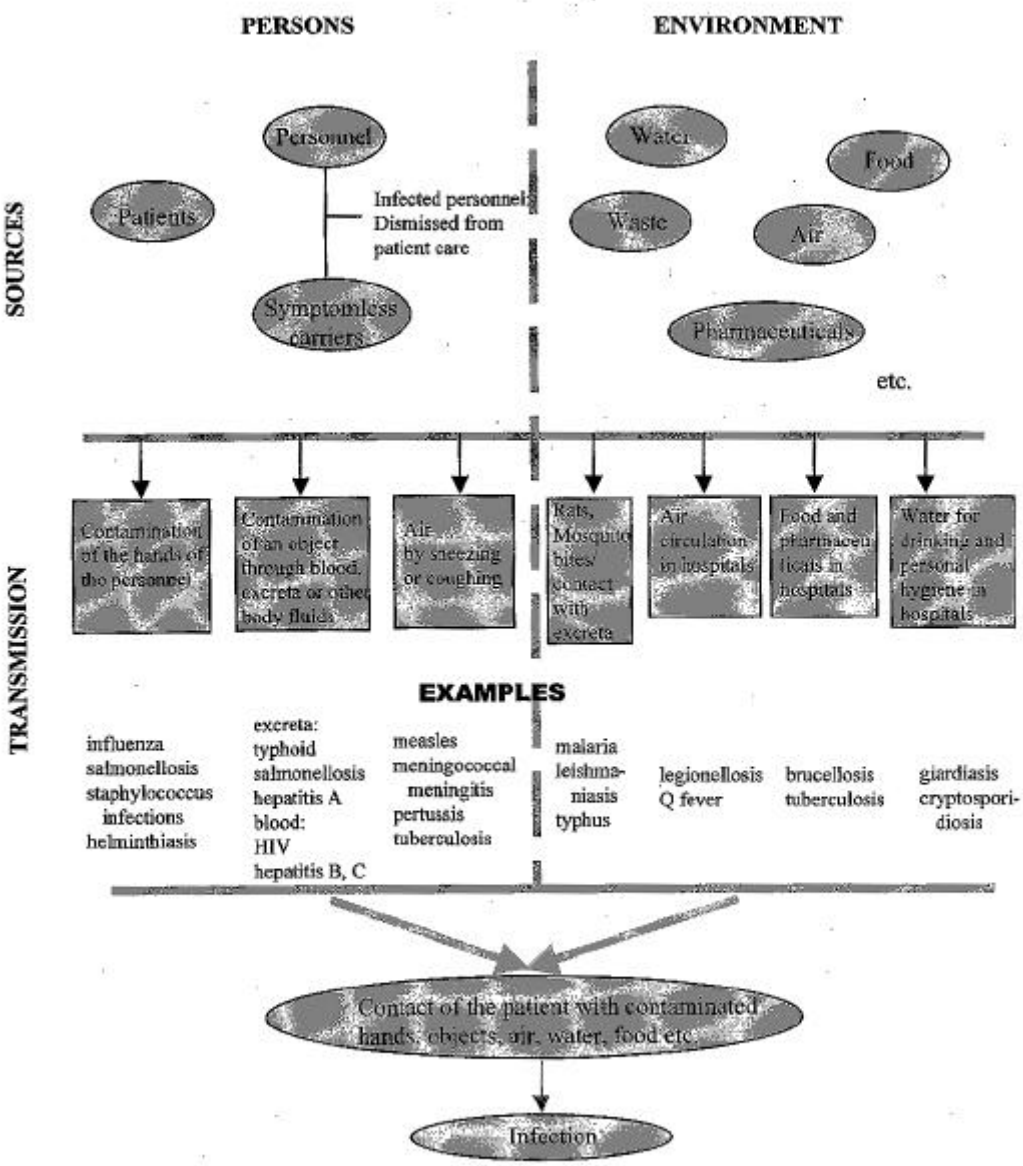
- 32 from syringe needle injuries
- 1 from blade injury
- 1 from glass-tube injury
- 1 from contact with non-sharp infectious item
- 4 from skin or mycosis exposure

In June 1996, the cumulative recognized cases of occupational HIV infections had risen to 51. All cases were nurses, medical doctors or laboratory assistants.

France:
In 1992, 8 cases of HIV infections were recognized as occupational infections. Two cases of HIV transmission through infected wounds were reported among waste handlers

Handout 1.4

Spreading of nosocomial infections



Note: Many of the listed diseases can spread via more than one route.
This list contains only a few examples compared to the many diseases that may br transmitted within a hospital setting.

Reduced overheads - Lecture 1

Overhead 1.1

Definitions

Health-care waste

Total waste stream from HCW generators
(major and scattered sources)

Hazardous health-care waste

75 - 90% of general waste (similar to domestic waste)
10 - 25% is hazardous (infectious, toxic etc.)

World Health Organization

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Overhead 1.2

Health-care activities

Health-care activities (for humans) generating waste include:

- Diagnosis
- Treatment
- Prevention of diseases
- Alleviation of disablement
- Associated research

World Health Organization

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Overhead 1.3

Hazardous health-care waste

- Infectious
- Pathological
- Sharps
- Pharmaceutical
- Genotoxic
- Chemical
- Heavy metals
- Pressurized containers
- Radioactive

World Health Organization

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Overhead 1.4

Major sources of health-care waste

- Hospitals
- Clinics
- Laboratories
- Research centres
- Animal Research
- Bloodbanks
- Nursing Homes
- Mortuaries
- Autopsy centres

World Health Organization

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Overhead 1.5

Minor sources of health-care waste

- Physician's office
- Dental clinics
- Home health-care
- Nursing homes
- Acupuncturists
- Psychiatric clinics
- Cosmetic piercing and tattooing
- Funeral services
- Paramedic services
- Institutions for disabled persons

World Health Organization

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Overhead 1.6

HCW Generation by Region

Region	kg/bed/day
North America	7 - 10
Latin America	3
Western Europe	3 - 6
Eastern Europe	1.4 - 2
Middle East	1.3 - 3
East Asia High Income	2.5 - 4
East Asia Middle Income	1.8 - 2.2

World Health Organization

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Reduced overheads - Lecture 1

Overhead 1.7

What is Risk ?

the probability that the hazard
of a substance will cause harm
and the severity of that harm

World Health Organization

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Overhead 1.8

Hazardous properties of HCW

Hazardous HCW may have the following properties:

- contains infectious agents
- genotoxic
- contains hazardous chemicals or pharmaceuticals
- radioactive
- contains sharps

World Health Organization

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Overhead 1.9

Hazardous properties of chemicals

- Toxic
- Corrosive
- Flammable
- Reactive
- Explosive
- Shock sensitive
- Genotoxic

World Health Organization

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Overhead 1.10

Who is at Risk ?

- Doctors and nurses
- Patients
- Hospital support staff
- Waste collection and disposal staff
- General public

World Health Organization

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Overhead 1.11

Public health risks of hazardous HCW

Potential health effects:

- AIDS
- Hepatitis B and C
- Gastroenteric infections
- Respiratory infections
- Blood stream infections
- Skin infections
- Effects of radioactive substances
- Intoxication

World Health Organization

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Overhead 1.12

Public sensitivity

Public sensitivity

- about incidents involving HCW
- about visual impact of HCW

Cultural practices should be taken into account in HCW management.

World Health Organization

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3.3 Lecture 2
Introduction to legislation

Overheads

Overhead 2.1	Introduction to legislation - International agreements and principles
Overhead 2.2	Basel Convention, 1989
Overhead 2.3	Polluter Pays Principle
Overhead 2.4	Precautionary Principle
Overhead 2.5	Duty of Care for wastes
Overhead 2.6	Proximity Principle
Overhead 2.7	National Legislation
Overhead 2.8	National Law
Overhead 2.9	Policy Document
Overhead 2.10	Technical Guidelines

Teacher-s notes

Handouts

Handout 2.1	Legal package - proposed content

Reduced overheads

Introduction to legislation

International agreements and principles

- Basel Convention
- Polluter Pays Principle
- Precautionary Principle
- Duty of Care Principle
- Proximity Principle

Overhead 2.2

Basel Convention, 1989

- Coodinated by the United Nations Environment Programme (UNEP)
- Signed by more than 100 Nations (Parties)
- Controls transboundary movements of hazardous waste

Overhead 2.3

Polluter Pays

All waste producers are legally and financially responsible for:

–safe handling

–environmentally sound disposal

–creating an incentive to produce less

Precautionary Principle

Where risk is uncertain or unknown:

- Assume risk is significant
- Plan protection measures accordingly

“Duty of Care” for wastes

The “duty of care” principle stipulates that any person handling or managing hazardous substances or related equipment is ethically responsible for applying the utmost care.

Proximity Principle

Treatment and disposal of waste takes place as near as possible to the point of production as is technically and environmentally possible

National Legislation

- National legislation is the basis for improving HCW practices
- Permits legal controls and applying pressure
- Legal package: a law, a policy document and technical guidelines

Overhead 2.8

National Law

- Clear definitions
- Defined responsibilities
- Duty of Care of waste producer
- Tracking systems and record keeping
- Defined penalties
- Regulatory and enforcement systems

Overhead 2.9

Policy Document

- Description of health and safety risks
- Reasons for safe and sustainable health-care waste management
- Description of approved methods of waste minimization, handling and disposal
- Record keeping and documentation
- Training
- Health and safety protection rules

etc.

Technical Guidelines

- **Outline of the legal framework**
- **Responsibilities of actors**
- **Safe practices for :**
  - Minimization
  - Segregation
  - Storage
  - Handling
  - Transport
  - Treatment and Disposal

Teacher=s notes - Lecture 2

Overhead 2.1

International agreement has been reached on some underlying principles governing either public health or safe management of hazardous wastes.
These are explained in more detail in the following slides.

Overhead 2.2

The Basel Convention: Signed by more than 100 countries, this convention concerns transboundary movements of hazardous waste and is also applicable to hazardous health-care waste. Countries that signed this convention accepted the principle that the only legitimate transboundary shipments of hazardous waste are exports from countries without facilities, or expertise to dispose safely of certain wastes, to countries which have both facilities and expertise. Exported waste should be labelled according to the United Nations recommended standards.

Overhead 2.3

The Apolluter pays@ principle implies that any waste producer is legally and financially responsible for the safe and environmentally sound disposal of the waste he has produced. This principle also attempts to channel liability to the part which caused the damage.
Wherever practicable the polluter should pay for the costs they impose on the environment, whether they are national government, local government, commerce or industry or members of the public.

Overhead 2.4

The Aprecautionary@ principle is a key principle governing health and safety protection. When a certain risk is insufficiently known, it should be assumed that this risk is significant. Health and safety protective measures should be designed accordingly.

Overhead 2.5

The producer should have objective standards by which the Duty of Care may be measured, which would apply locally, nationally and internationally (for example the Basel Convention).

Overhead 2.6

The Aproximity@ principle recommends that treatment and disposal of hazardous waste take place at the closest possible location from its source in order to minimize the risks linked to its transport. According to a similar principle, any community should either recycle or dispose of the waste it has produced, inside its own territorial limits.

Overhead 2.7

National legislation is the basis for improving health-care waste practices of a country. This will permit legal controls and allow the national agency responsible for the disposal of health-care waste, usually the Ministry of Health, to apply pressure. The Ministry of Environment or the Environmental Protection Agency may also be involved. In this case there should be a clear distribution of responsibilities before initiating the process.
The legislation framework should consist in a law, completed by a policy document and technical guidelines, to be annexed to the law or to be considered as regulations issued from the law.

Overhead 2.8

A national law on health-care waste management may stand alone or be part of a more comprehensive law, e.g. law on hazardous waste management (application to health-care waste should be clearly stated), or law on hospital hygiene (a specific chapter or article should be devoted to health-care waste).
Operating a hospital and the disposal of health-care waste also has to comply with existing legislation related to it, e.g. waste regulations, air quality regulations, prevention and control of infectious disease regulations etc.)

Overhead 2.9

The policy document should outline the rationale, national goals and the key steps to achieve these goals.
Additional points that should be contained in the policy document are listed in Handout 2.1.

Overhead 2.10

The technical guidelines should be practical and directly applicable and include specifications, with a sufficient degree of detail.

Handout 2.1

Legal package - proposed content

A National Law

The law (or section) on HCW management should include the following:

- A clear and properly categorized definition of hazardous health-care waste;
- Detailed legal requirements for all persons who are producers, carriers, or who are engaged in the treatment and disposal of hazardous health-care waste so as to prevent harm to human health or pollution of the environment;
- The methodology for record keeping and reporting;
- A regulatory system for enforcing the law;
- The penalties applicable to offenders and the designation of the law courts where cases will be tried.

The policy document

The policy document should outline the rationale, national goals and the key steps to achieve these goals. It may contain the following:

- Description of health and safety risks resulting from mismanaged health-care waste;
- Reasons for safe health-care waste management practices in health-care establishments;
- Listing of approved methods of treatment and disposal for each waste category;
- Warning against the most unsafe practices, such as disposing of hazardous health-care waste in municipal landfills;
- Management responsibilities inside and outside health-care establishments;
- Assessment of health-care waste management costs;
- The key steps of health-care waste management: waste minimisation, separation, identification, handling, treatment, final disposal. Technical specifications for the implementation of each step should be described in separate technical guidelines.
- Record keeping and documentation;
- Training requirements;
- Rules governing workers health and safety protection.

Handout 2.1 (continued)

The technical guidelines

The technical guidelines should be practical and directly applicable and include the following specifications, with a sufficient degree of detail:

- Legal framework covering safe health-care waste management, hospital hygiene and occupational health and safety. Limitations for the emissions of atmospheric pollutants and protection of water resources may be addressed here or in the other national guidelines;
- Responsibilities of the public health authorities, of the environmental protection agency, of the head of the health-care establishments, of the small producers in the community, of public waste management organizations and of private waste management agencies involved;
- Safe practices for waste minimization;
- Segregation, handling, storage and transport practices for health-care waste;
- Recommended treatment and disposal methods for each health-care waste category and wastewater.

For ease of application, the legal definitions of each category of health-care waste should be repeated in the technical guidelines.

Reduced overheads - Lecture 2

Overhead 2.1

Introduction to legislation
International agreements and principles

- Basel Convention
- Polluter Pays Principle
- Precautionary Principle
- Duty of Care Principle
- Proximity Principle

World Health Organization

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Overhead 2.2

Basel Convention, 1989

- Coodinated by the United Nations Environment Programme (UNEP)
- Signed by more than 100 Nations (Parties)
- Controls transboundary movements of hazardous waste

World Health Organization

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Overhead 2.3

Polluter Pays

All waste producers are legally and financially responsible for:

–safe handling
–environmentally sound disposal
–creating an incentive to produce less

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Overhead 2.4

Precautionary Principle

Where risk is uncertain or unknown:

- Assume risk is significant
- Plan protection measures accordingly

World Health Organization

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Overhead 2.5

"Duty of Care" for wastes

The "duty of care" principle stipulates that any person handling or managing hazardous substances or related equipment is ethically responsible for applying the utmost care.

World Health Organization

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Overhead 2.6

Proximity Principle

Treatment and disposal of waste takes place as near as possible to the point of production as is technically and environmentally possible

World Health Organization

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Reduced overheads - Lecture 2

Overhead 2.7

National Legislation

- National legislation is the basis for improving HCW practices
- Permits legal controls and applying pressure
- Legal package: a law, a policy document and technical guidelines

World Health Organization

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Overhead 2.8

National Law

- Clear definitions
- Defined responsibilities
- Duty of Care of waste producer
- Tracking systems and record keeping
- Defined penalties
- Regulatory and enforcement systems

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Overhead 2.9

Policy Document

- Description of health and safety risks
- Reasons for safe and sustainable health-care waste management
- Description of approved methods of waste minimization, handling and disposal
- Record keeping and documentation
- Training
- Health and safety protection rules

etc.

World Health Organization

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Overhead 2.10

Technical Guidelines

- **Outline of the legal framework**
- **Responsibilities of actors**
- **Safe practices for :**
  - Minimization
  - Segregation
  - Storage
  - Handling
  - Transport
  - Treatment and Disposal

World Health Organization

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3.4 Workshop 1
Current national and local legislation

This workshop should review existing regulations and foster a discussion on possible improvements.

In your country what is the national and local legislation dealing with health-care waste? Try to answer the following questions (take 15 minutes at the end of the session for answering question 10):

1) Describe the national or regional regulations that apply to wastes and hazardous wastes.
2) What national or regional regulations address health-care wastes?
3) What legislation is there for the health and safety of workers?
4) Describe the legislation dealing with public health and how does the handling of health-care waste impact upon it?
5) Are there legal requirements to segregate health-care waste?
6) What legislation is there for the transportation of hazardous substances and does it affect HCW management?
7) What is the law dealing with waste collection and disposal and what if any are the specific laws or guidelines dealing with HCW management ?
8) What air quality legislation is likely to have an impact on health-care waste management?
9) What international agreements and protocols has the Government signed?
10) After having assessed the legal framework in your country, outline which type of legal documents or instruments would be required in your country/region.

3.5 Lecture 3
National programme for HCW management

Overheads

Overhead 3.1	International recommendations for waste management United Nations Conference on Environment and Development
Overhead 3.2	Action plan for a national programme of HCW management
Overhead 3.3	Policy commitment
Overhead 3.4	Conduct national survey
Overhead 3.5	Develop national policy and guidelines
Overhead 3.6	Develop treatment policies
Overhead 3.7	Develop national laws
Overhead 3.8	Implement a national training programme
Overhead 3.9	Establish a review of the HCW management programme

Teacher=s notes

Handouts

Handout 3.1	Action Plan for a national programme of sound health-care waste management

Reduced overheads

International recommendations for waste management
United Nations Conference on Environment and Development

Agenda 21 Waste Hierarchy

- Prevent or Minimize
- Re-use or recycle
- Incinerate with heat recovery
- Use alternative to incineration
- Landfill the residues

Overhead 3.2

Action Plan for a national programme of health-care waste management

- Establish policy commitment
- Conduct a national survey
- Develop national guidelines
- Policy for regional cooperation
- Legislate
- National training programme
- Regularly review the plan

Overhead 3.3

Policy commitment

- Designate the reponsible authority

  (usually Ministry of Health or of Environment)
- Interact with other government departments
- Commitment to developing a national policy
- Allocate a budget at different government levels

Overhead 3.4

Conduct national survey

- Design and test the survey
- Distribute nationally
- Analyse results
- Use results for guidelines

Overhead 3.5

Develop national policy and guidelines

- Analyze present legislation
- Consult hospitals and other waste producers
- Use survey results
- Draft national policy and technical guidelines

Overhead 3.6

Develop treatment policies

- **Consider public and private services**
- **Consider suitable treatment methods**
  Alternative Treatment Methods
    On-site treatment options
    Regional Facilities
- **Consider centralized and decentralized treatment**
- **Establish a national network of disposal facilities**

Develop national laws

- Examine international principles
- Use input from hospitals
- Include technical standards
- Prepare laws

Implement a national training programme

- Develop the programme
- Train the trainers
- Identify Institutions to deliver training
- Implement

Establish a review of the HCW management programme

- Create a review system of HCW management practices
- Carry out audits of waste treatment facilities
- Identify new technologies and practices
- Review report submitted by health-care establishments
- Implement improvements

Teacher=s notes - Lecture 3

Overhead 3.1

The United Nations Conference on the Environment and Development (UNCED) in l990 led to the adoption of Agenda 2l and the concept of Asustainable development@. Sustainable development has been defined as Adevelopment that meets the needs of the present without compromising the ability of future generations to meet their own needs@.
One of the key precepts of the Action Programme is the sharing of responsibility which requires dialogue and action by all partners in society.

Overhead 3.2

A national plan will permit optimizing HCW management options on a national scale. It will provide a basis to the authorities for identifying actions at national or regional level.
The development of a national programme of sound health-care waste management is achievable through a seven step Action Plan. These seven steps and their suggested time frame are listed in Handout 3.1.

Overhead 3.4

Before the planning process can begin, a knowledge of the waste produced needs to be obtained. A waste survey should therefore be undertaken with the objective of informing the waste planning process. It should provide information on types and quantity of wastes arising at each point of production, and methods of storage, handling, treatment and disposal. It should also provide the number of beds and occupancy rate for health-care establishments and personnel involved in HCW management.

Overhead 3.6

The policy should optimize HCW management at national and regional level. The planning policy will depend on local circumstances such as administrative control, number and location of health-care establishments, quality of road network, size and type of health-care establishments, financial and technical resources.

Overhead 3.7

The developed policy and guidelines should be supported by a law regulating their application. This law is usually based on international agreements and underlying principles on sound waste management. The suggested content is outlined in Handout 2.1.

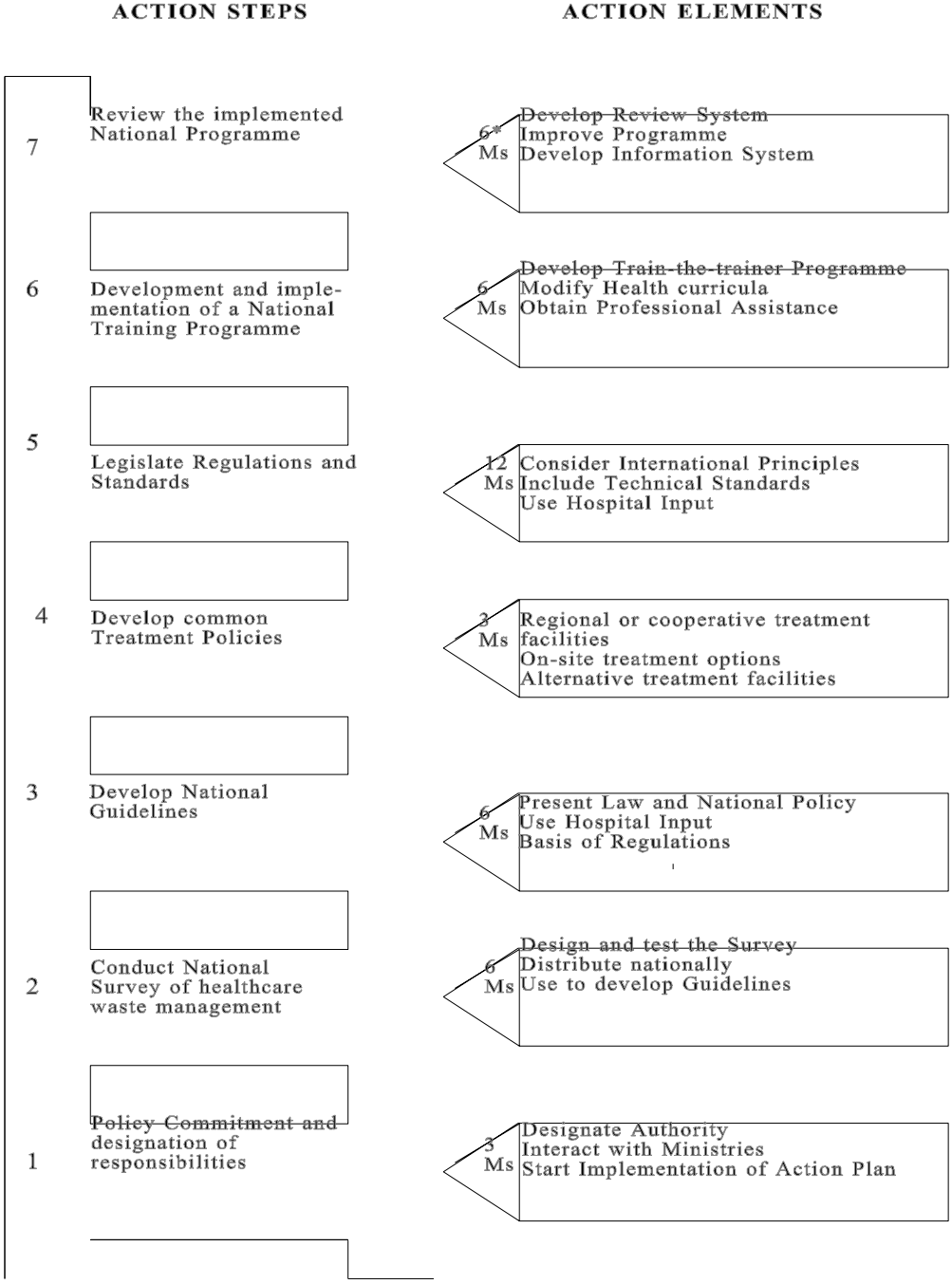
Overhead 3.8

In order to achieve acceptable HCW management practices and compliance with regulations, training of all managers and other personnel involved in HCW management is essential. The central government should assist in the preparation of Atrain-the-trainer= activities.

Overhead 3.9

The national programme should be viewed as a continuous one with periodic monitoring and assessment by the national government agency responsible for the disposal of HCW.

Handout 3.1: Action Plan for a national programme of sound health-care wastes management



*Time frame in months to complete action

Source: World Health Organization, Regional Office for South-East Asia, 1997.

Reduced overheads - Lecture 3

Overhead 3.1

International recommendations for waste management
United Nations Conference on Environment and Development

***Agenda 21* Waste Hierarchy**

- Prevent or Minimize
- Re-use or recycle
- Incinerate with heat recovery
- Use alternative to incineration
- Landfill the residues

World Health Organization

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Overhead 3.2

Action Plan for a national programme of health-care waste management

- Establish policy commitment
- Conduct a national survey
- Develop national guidelines
- Policy for regional cooperation
- Legislate
- National training programme
- Regularly review the plan

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Overhead 3.3

Policy commitment

- Designate the reponsible authority
  (usually Ministry of Health or of Environment)
- Interact with other government departments
- Commitment to developing a national policy
- Allocate a budget at different government levels

World Health Organization

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Overhead 3.4

Conduct national survey

- Design and test the survey
- Distribute nationally
- Analyse results
- Use results for guidelines

World Health Organization

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Overhead 3.5

Develop national policy and guidelines

- Analyze present legislation
- Consult hospitals and other waste producers
- Use survey results
- Draft national policy and technical guidelines

World Health Organization

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Overhead 3.6

Develop treatment policies

- **Consider public and private services**
- **Consider suitable treatment methods**
  Alternative Treatment Methods
  On-site treatment options
  Regional Facilities
- **Consider centralized and decentralized treatment**
- **Establish a national network of disposal facilities**

World Health Organization

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Reduced overheads - Lecture 3

Overhead 3.7

Develop national laws

- Examine international principles
- Use input from hospitals
- Include technical standards
- Prepare laws

World Health Organization

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Overhead 3.8

Implement a national training programme

- Develop the programme
- Train the trainers
- Identify Institutions to deliver training
- Implement

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Overhead 3.9

Establish a review of the HCW management programme

- Create a review system of HCW management practices
- Carry out audits of waste treatment facilities
- Identify new technologies and practices
- Review report submitted by health-care establishments
- Implement improvements

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3.6 Lecture 4
HCW management programme for a health-care establishment

Overheads

Overhead 4.1	Health-care waste management in a hospital
Overhead 4.2	Waste management responsibilities
Overhead 4.3	Duties of the Head of the establishment
Overhead 4.4	Duties of the Waste Management Officer
Overhead 4.5	Duties of other key staff
Overhead 4.6	The Waste Management Plan
Overhead 4.7	Implementation of the Plan
Overhead 4.8	Waste from scattered small sources

Teacher-s notes

Lecture Handout

Handout 4.1	Hospital waste management structure
Handout 4.2	Sample sheet for the assessment of waste generation
Handout 4.3	The Waste Management Plan - Content

Reduced overheads

Health-care waste management in a hospital

Good waste management depends on:

- A dedicated Waste Management Team
- Good administration
- Careful planning
- Sound organisation
- Underpinning legislation
- Adequate financing
- Full participation by trained staff

Waste management responsibilities

- **Project Executive:** **Hospital Manager**
- **Project Manager:** **Waste Management Officer**
- **Project Team Members:**

Hospital manager
Waste Management Officer
Heads of departments
Infection Control Officer
Senior Nursing Officer

Hospital Engineer
Finance Controller
Chief Pharmacist
Radiation Officer

Overhead 4.3

Duties of the Head of the establishment

- Form a waste management team
- Designate the Waste Management Officer
- Allocate financial resources and manpower
- Ensure that monitoring procedures are carried out
- Ensure adequate training of key staff members

Overhead 4.4

Duties of the Waste Management Officer

- Control internal waste collection
- Ensure correct storage
- Coordinate disposal operations
- Monitor on-site and off-site transportation of waste
- Liaise with department heads to ensure training is carried out
- Monitor waste generation, disposal, costs and public health aspects (e.g. injuries) of waste

Overhead 4.5

Duties of other key staff

Department Heads, Senior Nursing Officer, Infection Control Officer:

Contribute to training and implementation of correct procedures

Chief Pharmacist, Radiation Officer, Supply Officer :

Same duties as above and responsible for the sound management of stores

Hospital Engineer

Same as above and responsible for installing and maintaining storage facilities and handling equipment

Overhead 4.6

The Waste Management Plan

1 Assess present situation and carry out a waste survey
2 Identify opportunities for minimization, reuse and recycling
3 Identify handling, treatment and disposal options
4 Evaluate options
5 Prepare a management plan
6 Establish a record keeping system
7 Estimate related costs
8 Prepare training programme
9 Prepare implementation strategy

Implementation of the Plan

The implementation is the responsibility of the Head of the establishment

- Phased introduction
- Opportunities for expansion
- Identify key personnel network
- Arrange training
- Implement
- Review the plan annually
- Prepare annual report for national government

Waste from scattered small sources

- Ensure that hazardous HCW is **segregated**
- **Prevent** hazardous HCW causing pollution of the environment or harm to human health
- Where possible arrange for **special collection**
- Ensure that the hazardous HCW is only handled and disposed of by **competent persons**

Teacher=s notes - Lecture 4

Overhead 4.1

Health-care waste management in hospitals or other health-care establishments relies on several necessary elements, which are listed on the overhead.

Overhead 4.2

Before commencing work on examining waste management practices and developing a waste management plan, it is essential to establish within any health-care establishment the responsibilities for waste management. A suitable team should then be assembled, by formal appointment by the establishment=s head, with clearly defined duties. It is desirable that one person is given the responsibility for waste management matters (the AWaste Management Officer@) with direct access to the Head of the establishment.
A typical waste management structure for a relatively large hospital is given in Handout 4.1. It may be adjusted to the particular needs of each establishment. In smaller establishments, one person may carry out several tasks.

Overhead 4.4

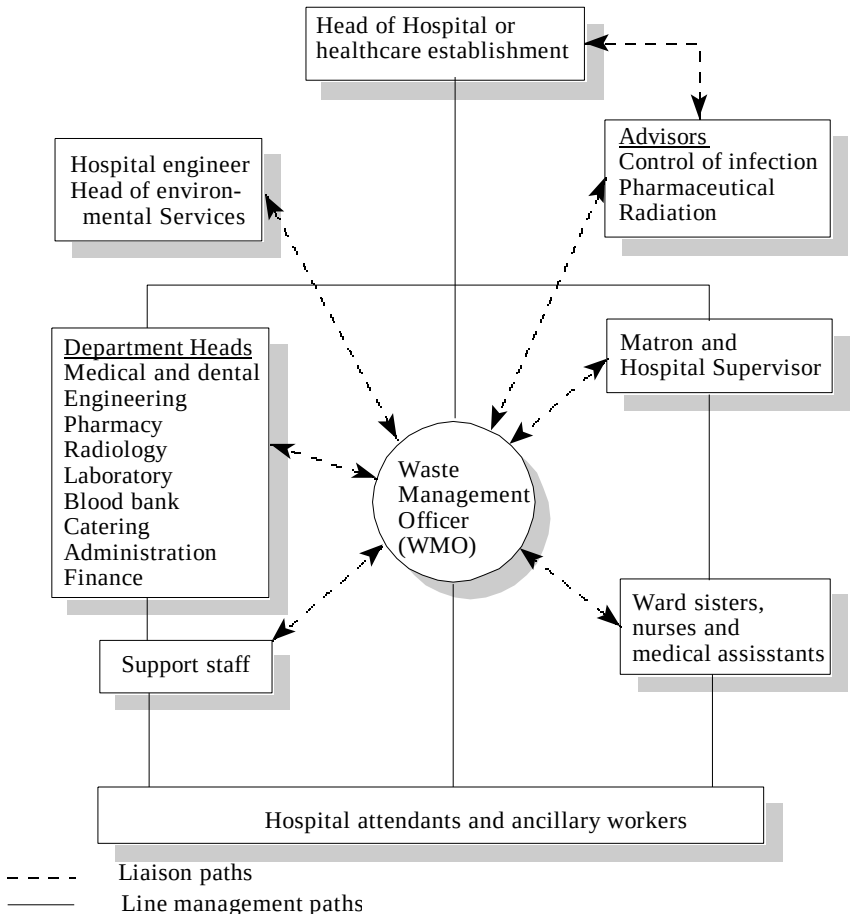
The Waste Management Officer (WMO) is responsible for the day to day operation and monitoring of the waste management system. He directly reports to the Head of the establishment.

Overhead 4.6

The generation of waste needs to be assessed before considering management options. Categories and location of production of the wastes should be specified as accurately as possible. A sample sheet for assessment of waste generation is provided in handout 4.2.
The Waste Management Officer should prepare a draft Waste Management Plan, to be presented to the Waste Management Team, containing the elements outlined in Handout 4.3.

Handout 4.1

Hospital waste management structure



Source: World Health Organization, Western Pacific Regional Environmental Health Centre (EHC), 1994

Handout 4.2

Sample sheet for assessment of waste generation

Name of the health-care facility: ..... Week: .....

Waste collection point: Department/Location	Waste category[1] (specify)	Quantity of waste generated per day (weight and volume)													
		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
		kg	l	kg	l	kg	l	kg	l	kg	l	kg	l	kg	l

Source: Christen/SKAT, 1996

[1]Infectious waste, pathological waste, sharps, pharmaceutical wastecytotoxic waste, chemical waste, wastes with high content of heavy metals, radioactive waste

Handout 4.3

Waste Management Plant - Contents

a) Drawings of the establishment showing designated bag holder sites for every ward and department in the health-care establishment; each bag site shall be appropriately designated as health-care waste or other waste site;

b) Drawings showing the site of the central storage for health-care waste and the separate site for other waste; details of the type of containers, security equipment and arrangements for washing and disinfecting trolleys (e.g. wheeled) should be specified; the document should also address eventual needs for refrigerated facilities;

c) Drawings showing the paths of waste collection trolleys through the health-care establishment, with clearly marked individual collection routes;

d) A timetable for the frequency of collection for each trolley route, the type of waste to be collected, the number of wards and departments to be visited on one round and indicating the central storage point in the establishment for that particular waste;

e) Drawings showing the type of bag holder to be used in the wards and departments;

f) Drawings showing the type of trolley or wheeled container to be used for bag collection;

g) Drawings of sharps containers with their specification;

h) An estimate of the numbers and cost of bag holders and collection trolleys;

I) An estimate of the number of sharps containers and health-care waste drum containers required annually,categorized into different sizes if appropriate;

j) An estimate of the number and costof yellow and black plastic bags to be used annually;

k) Definitions of responsibilities, duties and codes of practice for each of the different categories of personnel of the establishment who, through their daily work, will generate health-care waste and be involved in the segregation, storage and handling of the waste;

l) An estimate of the number of personnel required for waste collection;

m) A definition of the responsibilities of hospital attendants and ancillary staff in collection and handling of wastes, for each ward and department; where special practices are required, e.g. for radioactive waste or hazardous chemical waste, the stage at which attendants or ancillary staff become involved in waste handling shall be clearly defined;

n) Simple diagram (flow chart) showing waste segregation procedure;

o) The procedures for segregation, storage and handling of wastes requiring special arrangements, such as autoclaving;

p) Outline of monitoring procedures for waste categories and their destination;

q) Contingency plans, containing instructions on storage or evacuation of health-care waste in case of breakdown of the treatment unit or when closed down for planned maintenance;

r) Training courses and programmes;

s) Emergency procedures.

Adapted from: World Health Organization, Western Pacific Regional Environmental Health Centre (EHC), 1994

Reduced overheads - Lecture 4

Overhead 4.1

Health-care waste management in a hospital

Good waste management depends on:

- A dedicated Waste Management Team
- Good administration
- Careful planning
- Sound organisation
- Underpinning legislation
- Adequate financing
- Full participation by trained staff

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Overhead 4.2

Waste management responsibilities

- **Project Executive:** **Hospital Manager**
- **Project Manager:** **Waste Management Officer**
- **Project Team Members:**

Hospital manager
Waste Management Officer
Heads of departments
Infection Control Officer
Senior Nursing Officer

Hospital Engineer
Finance Controller
Chief Pharmacist
Radiation Officer

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Overhead 4.3

Duties of the Head of the establishment

- Form a waste management team
- Designate the Waste Management Officer
- Allocate financial resources and manpower
- Ensure that monitoring procedures are carried out
- Ensure adequate training of key staff members

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Overhead 4.4

Duties of the Waste Management Officer

- Control internal waste collection
- Ensure correct storage
- Coordinate disposal operations
- Monitor on-site and off-site transportation of waste
- Liaise with department heads to ensure training is carried out
- Monitor waste generation, disposal, costs and public health aspects (e.g. injuries) of waste

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Overhead 4.5

Duties of other key staff

Department Heads, Senior Nursing Officer, Infection Control Officer:

Contribute to training and implementation of correct procedures

Chief Pharmacist, Radiation Officer, Supply Officer :

Same duties as above and responsible for the sound management of stores

Hospital Engineer

Same as above and responsible for installing and maintaining storage facilities and handling equipment

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Overhead 4.6

The Waste Management Plan

1 Assess present situation and carry out a waste survey
2 Identify opportunities for minimization, reuse and recycling
3 Identify handling, treatment and disposal options
4 Evaluate options
5 Prepare a management plan
6 Establish a record keeping system
7 Estimate related costs
8 Prepare training programme
9 Prepare implementation strategy

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Reduced overheads - Lecture 4

Overhead 4.7

Implementation of the Plan

The implementation is the responsibility of the Head of the establishment

- Phased introduction
- Opportunities for expansion
- Identify key personnel network
- Arrange training
- Implement
- Review the plan annually
- Prepare annual report for national government

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Overhead 4.8

Waste from scattered small sources

- Ensure that hazardous HCW is **segregated**
- **Prevent** hazardous HCW causing pollution of the environment or harm to human health
- Where possible arrange for **special collection**
- Ensure that the hazardous HCW is only handled and disposed of by **competent persons**

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3.7 Workshop 2
HCW management plan

Participants should be divided into two groups, according to their professional field of activity and interests:

I) Action plan for implementation of national HCW management
(mainly for participants from national or regional authorities and policy makers)

Using the Handout 3.1 as a basis:

1) Go through the steps and decide what step your country has reached.
2) Which would be the aspects that would still have to be covered in your country?
3) How would the step sequence differ in your country compared with the Handout?
4) Now devise an action plan for the implementation of a national programme for health-care waste management.

II) How to improve the HCW management plan of the health-care establishment
(mainly for participants from health-care establishments)

Using the Handouts of Lecture 4:

1) Are the responsibilities for health-care waste management clearly assigned in your establishment?
2) What is the structure for waste management in place? Compare it to Handout 4.1.
3) Has a waste management plan been established?
4) Do you feel that additional issues would have to be addressed in the waste management plan?
5) Outline possible improvements.
6) Formulate a strategy on how the improvements could be achieved.
7) What are your relations with the authority responsible for HCW?

Participants should designate a speaker in each group who will report to plenary the results of the working group. These results should be presented about 30 minutes before the end of the workshop.

3.8 Lecture 5
Minimization, recycling and segregation of HCW

Overheads

Overhead 5.1	Minimization, recycling and segregation - Waste minimization
Overhead 5.2	Reuse
Overhead 5.3	Recycling
Overhead 5.4	Waste segregation
Overhead 5.5	Recommended colour coding of containers

Teacher's notes

Handouts

Handout 5.1	Examples of policies and practices encouraging waste minimization
Handout 5.2	Recommended colour coding for health-care waste
Reduced overheads	

Minimization, recycling and segregation

Waste minimization

- Source reduction
- Use of recyclable products
- Purchasing policy
- Segregation
- Stock management

Overhead 5.2

Reuse

Materials should only be reused if they are designed for re-use

Plastic syringes and catheters should be discarded after use

There may be numerous opportunities for reuse of commonly used objects which are usually discarded after use

Recycling

Packaging materials can be recycled:

- Paper and cardboard
- Glass
- Metal containers
- Plastic wrappings

Consideration should be given to segregation of materials that could be recycled, considering the market opportunities.

Overhead 5.4

Waste segregation

- Key to waste minimization
- Essential for effective waste management
- Improves public health protection
- Should be done according to specific treatment and disposal requirements
- Should be carried out by waste producer
- Should be harmonized all over the country
- Same segregation from production until disposal

Recommended colour coding of containers

- **Yellow**- ***for infectious waste***
- **Brown**- ***for chemical and pharmaceutical waste***
- **Black**- ***for general waste***

Teacher=s notes - Lecture 5

Overhead 5.1

Before producing waste, it should be investigated whether the amount of generated waste could be reduced. This would also lead to reduced efforts in subsequent handling, treatment and disposal operations.
Policies that take into account environmental considerations and lead to reduced production of waste also usually result in reduced purchasing costs and costs related to waste management.
Segregation of waste, i.e. sorting into waste categories, leads to reduced quantities of hazardous waste, as the general waste is separated and follows the municipal waste stream. This greatly reduces the costs for safe disposal of hazardous health-care waste.

Overhead 5.2

The reuse of equipment has almost disappeared due to the marketing of single use items and the need to prevent the spread of nosocomial (e.g. hospital-acquired) diseases. This is particularly the case for medical items such as syringe needles. There are, however, other opportunities for recycling or reuse, in particular of objects which are not directly used for health-care.

Overhead 5.3

Hospital are often large producers of waste. If there is a market for recycled material, actions to contribute to recycling should be considered.
Long term contracts are a good way of ensuring markets.

Overhead 5.4

All management options outlined in this course are based on waste segregation. It is one of the essential points of health-care waste management. Given the fact that only about 10 to 25% of health-care waste is hazardous and the rest is similar to domestic waste, the treatment/disposal costs could greatly be reduced if hazardous health-care waste were segregated. In fact, the part of the health-care waste that is hazardous and requires special treatment would be reduced to a factor 4 to 10 if the hazardous part were separated from the rest.

Overhead 5.5

Handout 5.2 contains additional details on the recommended segregation and colour coding practices for HCW. The following remarks should be made concerning these practices:

- *General waste* (e.g. kitchen waste, similar to domestic waste) will join the municipal waste stream.
- *Highly infectious waste* should, whenever possible, be collected separately and sterilized immediately by autoclaving.
- *Sharps* will be collected in puncture-proof >Sharps boxes=.

- Small amounts of *chemical or pharmaceutical wastes* may be collected together with infectious waste.
- Wastes with *high content of heavy metals* should be collected separately (e.g. lead thermometers, batteries).
- *Low-level radioactive infectious waste* may be collected in yellow bags or containers if these are destined for incineration.

In establishments practising minimal programmes for HCW management (e.g. remote, smaller rural establishments) the segregation scheme may be simplified. These establishments should usually produce small quantities of pharmaceutical and chemical waste, and rarely radioactive or cytotoxic waste. The remarks to the table for minimal programmes are the following:

- In case *highly hazardous and hazardous waste* are disposed in the same way, these two waste categories should not be collected separately;
- In hospital using *genotoxic products*, it is highly recommended to enforce the safety procedures applicable to radioactive or genotoxic products.
- If *sharps* will be *encapsulated*, it will be convenient to collect them directly in the metallic drums or barrels used for encapsulation, which will limit handling hazards;
- For hazardous waste and highly hazardous waste containers the use of *double packaging*, e.g. a plastic bag inside a holder or container is recommended for ease of cleaning;
- *Stools of cholera patients* should be collected in buckets in view of their disinfection; their discharge to the sewers or the environment may contribute to the spreading of the epidemic.

Handout 5.1

Examples of policies and practices encouraging waste minimization

Source reduction

- Purchasing reductions: selection of supplies that are less wasteful or less hazardous;
- Use physical instead of chemical cleaning methods (e.g. steam disinfection instead of chemical disinfection);
- Prevent wastage of products, e.g in nursing wards and during cleaning.

Management and control measures at hospital level

- Centralize the purchasing of hazardous chemicals;
- Monitor chemical flows within the facility from receipt as raw materials to disposal as hazardous wastes.

Stock management of chemical and pharmaceutical products

- Order frequently relatively small quantities rather than large amounts at one time (applicable in particular to unstable products);
- The oldest parcel of a product should always be used first;
- The contents of each box or bottle is used till the bottom layer;
- Check expiration date of any product upon delivery.

Handout 5.2

Recommended segregation and colour coding for health-care waste

Type of waste	Colour of container	Type of container
Highly infectious waste	yellow marked "HIGHLY INFECTIOUS"	leak-proof and strong plastic bag, or container supporting autoclaving
Other infectious waste, pathological and anatomic waste	yellow	leak-proof plastic bag or container
Sharps	yellow marked "SHARPS"	puncture-proof container
Chemical and pharmaceutical waste	brown	plastic bag or container
Radioactive waste	-	lead box, labelled with the radioactive symbol
General health-care waste	black	plastic bag

Segregation and colour coding for HCW in minimal programmes
(e.g. remote, rural establishments)

Designation	**Hazardous waste container**	**Highly hazardous waste container**	**Sharps container**	**General waste bag**
Type of receptacle	Container or plastic bags in a holder	Container or plastic bags in a holder	Sealable box or drum, or cardboard box	Plastic bag or container
Colour	Yellow	Yellow, marked "HIGHLY INFECTIOUS"	Yellow, marked "SHARPS"	Black
Characteristics	Leak-proof	Leak-proof, suitable for autoclaving	Puncture-proof and leak-proof	No special requirements
Waste categories	Non-sharp infectious waste some pharmaceutical and chemical residues	Highly infectious non-sharp waste	Sharps	waste similar to municipal waste, not contaminated by hazardous substances

Reduced overheads - Lecture 5

Overhead 5.1

Minimization, recycling and segregation

Waste minimization

- Source reduction
- Use of recyclable products
- Purchasing policy
- Segregation
- Stock management

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Overhead 5.2

Reuse

Materials should only be reused if they are designed for re-use

Plastic syringes and catheters should be discarded after use

There may be numerous opportunities for reuse of commonly used objects which are usually discarded after use

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Overhead 5.3

Recycling

Packaging materials can be recycled:

- Paper and cardboard
- Glass
- Metal containers
- Plastic wrappings

Consideration should be given to segregation of materials that could be recycled, considering the market opportunities.

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Overhead 5.4

Waste segregation

- Key to waste minimization
- Essential for effective waste management
- Improves public health protection
- Should be done according to specific treatment and disposal requirements
- Should be carried out by waste producer
- Should be harmonized all over the country
- Same segregation from production until disposal

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Overhead 5.5

Recommended colour coding of containers

- **Yellow**- ***for infectious waste***
- **Brown**- ***for chemical and pharmaceutical waste***
- **Black**- ***for general waste***

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3.9 Lecture 6
Handling, storage and transportation
(updated, 1999**)**

Overheads

Overhead 6.1 Waste collection
Overhead 6.2 Waste storage facilities
Overhead 6.3 Waste storage periods
Overhead 6.4 Off-site transport
Overhead 6.5 Waste labelling
Overhead 6.6 Off-site vehicle design

Teacher's notes

Handouts

6.1 UN Dangerous Goods Transport Document
6.2 Example of a consignment note used in the U.K.
6.3 Route of the consignment note used in the U.K.
6.4 Example of labelling and UN label
6.5 Vehicle design for off-site transportation of hazardous health-care waste
Reduced overheads

Overhead 6.1

Waste Collection

- Establish a routine programme for collection
- Collect ward waste daily
- Waste bags should be sealed
- All containers and bags should be labeled
- Full containers should be immediately replaced with empty containers or bags

Waste storage facilities

- Impermeable, hard standing
- Good drainage
- Easy to clean surfaces
- Convenient water supply
- Readily accessible to staff
- Secure and lockable
- Good lighting and ventilation
- Proofed against rodents, insects and birds

Waste storage periods

Maximum Storage Times

Temperate Climate

- 72 Hours in winter
- 48 Hours in summer

Warm Climate

- 48 Hours in cool season
- 24 Hours in hot season

Off-site transport

- Waste Accompanied by a Consignment Note
- Transporter known to the Regulatory Authority
- Disposal facility permitted by Regulatory Authority

Overhead 6.5

Waste labelling

- Date of production
- Place of production (e.g. ward/ establishment*)
- Waste quantity
- Waste category
- Waste destination*
- UN symbol and class

*for off-site transport

Off-site vehicle design

Dedicated Vehicle

- Suitable size body with height of 2.2 metres
- Bulkhead between driver and body
- System to secure the load
- Separate compartment for emergency equipment
- Internal finish to allow for steam cleaning
- International hazard sign displayed

or: bulk container to be lifted on vehicle

- Used for storage and replaced when full

Teacher-s notes - Lecture 6

Overhead 6.1

Labeling bags enables the ward to be identified if the bags aremis-handled so that management can be improved. It also permits to determine the collection date of the waste. Furthermore it contains information on the content of the bag or container, and thus provides indications on its hazards.

Overhead 6.2

A storage location for health-care waste should be designated inside the health-care establishment or research facility. The waste should be stored in bags or containers in a confined place, either a separate area, room or building. It should be sized according to the generated waste quantities and frequency of collection. As the storage area is not accessible to unauthorized persons, it limits exposure of people trying to access the site and who would not be aware of the related hazards.
The storage facility should not be situated in proximity to food stores or food preparation areas.
Cytotoxic waste should be stored in a secure place, separate from the storage room devoted to other health-care waste. (Cytotoxic means possessing a specific destructive action on certain cells; e.g. substances used for treatment of cancer patients)
Radioactive waste should be stored in containers preventing dispersion, behind lead shielding. Waste designated for storage to allow decay should be labelled with the type of radionuclide, date and required storage details.

Overhead 6.3

Refrigerated storage allows for longer storage periods than those recommended on the overhead.
Cool Storage can be achieved by using a large refrigerated container.

Overhead 6.4

The waste producer is responsible for packaging, labeling and authorized transportation and destination of the waste. Healthcare waste should be packaged and labelled to comply with national regulations regarding the transport of hazardous wastes, and with international agreements if they are shipped abroad for treatment. In case there are no such national regulations, responsible authorities may refer to recommendations of the United Nations.
The form for transport of dangerous goods adapted from the recommendations by the United Nations (1999) is provided in Handout 6.1. Another example of consignment note, from the U.K., is reproduced on Handout 6.2, with its corresponding route on Handout 6.3.

Overhead 6.5

For off-site transport: In case of liability problem, the origin of the waste may be traced back. In case of accident, content of the containers can be quickly identified and appropriate actions taken. The information which should be contained on the label, as well as the recommended UN label for

transportation, are represented on Handout 6.4. The UN label bears the >International Infectious Substance Symbol=, with which all bags and containers containing infectious waste, sharps and pathological waste should be marked.
Additional recommendations on transporttion are contained in "Recommendations on the Transport of Dangerous goods", Model Regulations, 11th revised version, United Nations, New York, 1999, These recommendations are updated approximately every two years.

Handout 6.1:
Adapted Multimodal Dangerous Goods Form recommended by the United Nations (1999)

Shipper/ Consignor/ Sender (Name & Address)	Transport document number			
	Page 1 of Pages	Shipper=s reference		
		Freight Forwarder=s reference		
Consignee	Carrier (to be completed by the carrier)			
Additional handling information	**SHIPPER=S DECLARATION** I hereby declare that the contents of this consignment are fully and accurately described below by the proper shipping name, and are classified, packaged, marked and labelled/placarded and are in all respects in proper condition for transport according to the applicable international and national governmental regulations.			
Shipping marks Cube(m3)	Number & kind of packages; description of goods	Gross mass (kg)	Net mass	
Container identification No./ Vehicle registration	Seal number(s)	Container/vehicle size & type	Tare (kg)	Total gross mass (including tare) (kg)

CONTAINER/VEHICLE PACKING CERTIFICATE I hereby declare that the goods described above have been packed/ loaded into the container/ vehicle identified above in accordance with the applicable provisions **MUST BE COMPLETED AND SIGNED FOR ALL CONTAINER/ VEHICLE LOADS BY PERSON RESPONSIBLE FOR PACKING/ LOADING**	RECEIVING ORGANISATION RECEIPT Received the above number of packages/ containers/ trailers in apparent good order and condition unless stated hereon: RECEIVING ORGANISATION REMARKS:	
Name of the company	Haulier=s name	Name of company (of shipper preparing this note)
Name/ Status of declarant	Vehicle reg. no.	Name/ Status of declarant
Place and date	Signature and date	Place and date
Signature of declarant	DRIVER=S SIGNATURE	Signature of declarant

Handout 6.2: Example of a consignment note used in the U.K.

London Waste Regulation Authority
Waste Control Division
Hampton House, 20 Albert Embankment
London SE1 7TJ Telephone 071-587 3066

Serial Number 50/155050

Originator's Reference

CONSIGNMENT NOTE FOR THE CARRIAGE & DISPOSAL OF HAZARDOUS WASTE (Dept. of the Environment/Welsh Office/Scottish Office)

PRENOTIFICATION COPY

Producer's Certificate A

(1) The material described in B is to be collected from .....

.....

and (2) taken to .....

.....

Signed ..... Name .....

On behalf of ..... Position .....

Address ..... Telephone No. .....

Date .....

..... Estimated date of collection .....

Description of the Waste B

(1) General description and physical nature of waste

(2) Relevant chemical and biological components and maximum concentrations

(3) Quantity of waste and size, type and number of containers

(4) Process(es) from which waste originated

Carrier's Collection Certificate C

I certify that I collected the consignment of waste and that the information given in A(1) & (2) and B(1) and (3) is correct, subject to any amendment listed in this space:

I collected this consignment on ..... at ..... hours

Signed ..... Name ..... Date .....

On behalf of ..... Vehicle Reg. No: .....

Address ..... Telephone No: .....

.....

Producer's Collection Certificate D

I certify the information given in B & C is correct and that the carrier was advised of appropriate precautionary measures.

Signed ..... Name ..... Telephone ..... Date .....

Disposer's Certificate E

I certify that Waste Disposal Licence No. ..... , Issued by ..... County/ District Council, authorises the treatment/disposal at this facility of the waste described in B (and as amended where necessary at C)

Name and address of facility .....

.....

This waste was delivered in vehicle (Reg.No) ..... at ..... hours on (date) ..... and the carrier gave his name as ..... on behalf of ..... Proper instructions wre given that the waste should be taken to .....

.....

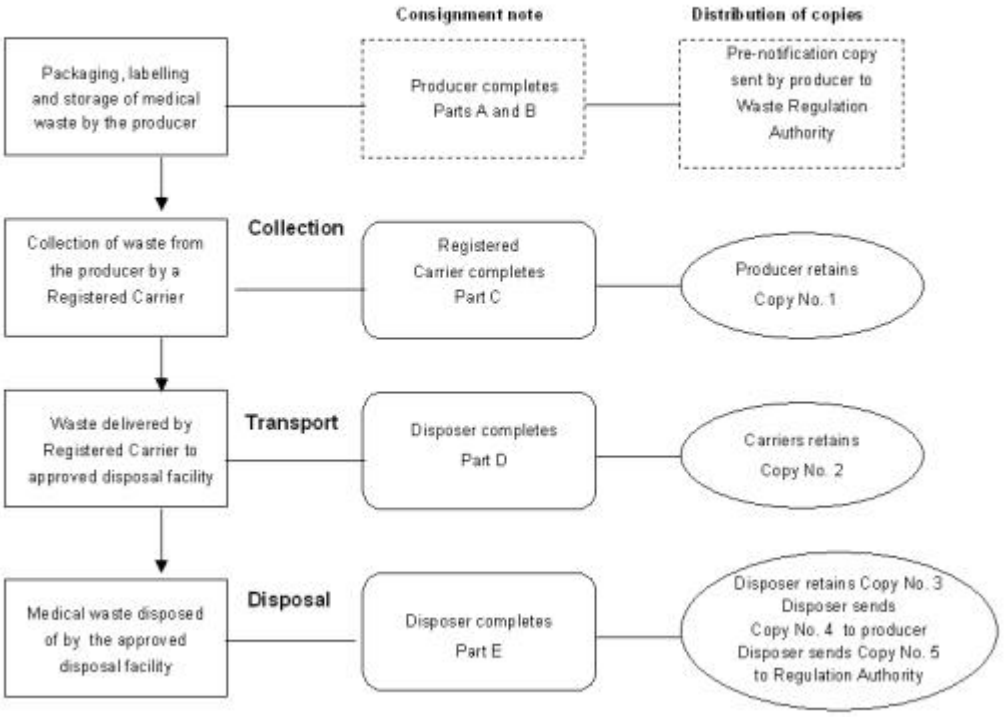
Signed ..... Name ..... Position .....

Date ..... on behalf of .....

For use by Producer/ Carrier/ Disposer

Handout 6.3

Route of the consignment note used in the U.K. (adapted)



Handout 6.4
Example of Labelling

UN CLASS 6.2

(UN Class)

INFECTIOUS HEALTH-CARE WASTE/Sharps

(Waste category)

GB/Queen' s University Hospital London

(Country by motor vehicle sign/name of producer)

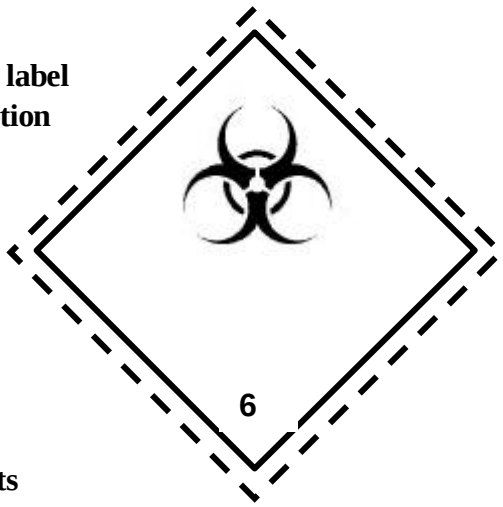
04.05.1999

(Date of packaging)

350 kg-Special Incinerator ARD, London
(Waste quantity-waste destination)

Recommended UN label for infectious substances, Class 6, Division 6.2

(Infectious)
The bottom part of the label should bear the inscription "INFECTIOUS SUBSTANCE"-
In case of damage or leakage immediately notify public health Authority"



Symbol (three crescents Superimposed on a circle) and incription:black background: white figure ' 6' in bottom corner

Handout 6.5

Vehicle design for off-site transportation of hazardous health-care waste

1) The body of the vehicle should be of a **suitable size**, with an internal body height of 2.2 metres.

2) There should be a **bulkhead** between the driver=s cabin and the body which is designed to retain the load if the vehicle is involved in a collision.

3) A suitable system should **secure** the load during transport.

4) A **separate compartment** on the vehicle should contain empty plastic bags, suitable protective clothing, cleaning equipment, tools and disinfectant, together with special kits for dealing with liquid spills.

5) The **internal finish** of the vehicle should allow it to be steam-cleaned and the internal corners should be coved.

6) **Name and address** of the waste carrier must be on the vehicle.

7) The **international hazard sign** should be displayed on the vehicle or container, as well as an emergency telephone number.

8) **Open-topped skips** or containers should never be used for transporting hazardous health-care waste.

9) Vehicles or containers used for the transportation of hazardous health-care waste should **not be used for** the transportation of **any other material**. They should be sealed and kept locked at all times, except when loading and unloading.

10) **Articulated or demountable trailers** (temperature controlled if required) are very suitable for health-care waste, as they can easily be left at the location of waste production.

11) **Other systems** may be used, such as specially designed large containers or skips.

12) Where the use of a specially dedicated vehicle cannot be justified, a **bulk container** which can be lifted on to the chassis may be considered. The container may be used for storage at the health-care establishment and replaced with an empty one when collected. **Refrigerated containers** may be used if the storage time exceeds the recommended period or if transportation times are long. The finish of these bulk containers should be smooth and impervious and permit easy cleansing or disinfection.

Overhead 6.1

Waste Collection

- Establish a routine programme for collection
- Collect ward waste daily
- Waste bags should be sealed
- All containers and bags should be labeled
- Full containers should be immediately replaced with empty containers or bags

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Overhead 6.2

Waste storage facilities

- Impermeable, hard standing
- Good drainage
- Easy to clean surfaces
- Convenient water supply
- Readily accessible to staff
- Secure and lockable
- Good lighting and ventilation
- Proofed against rodents, insects and birds

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Overhead 6.3

Waste storage periods

Maximum Storage Times

Temperate Climate

- 72 Hours in winter
- 48 Hours in summer

Warm Climate

- 48 Hours in cool season
- 24 Hours in hot season

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Overhead 6.4

Off-site transport

- Waste Accompanied by a Consignment Note
- Transporter known to the Regulatory Authority
- Disposal facility permitted by Regulatory Authority

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Overhead 6.5

Waste labelling

- Date of production
- Place of production (e.g. ward/ establishment*)
- Waste quantity
- Waste category
- Waste destination*
- UN symbol and class

*for off-site transport

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Overhead 6.6

Off-site vehicle design

Dedicated Vehicle

- Suitable size body with height of 2.2 metres
- Bulkhead between driver and body
- System to secure the load
- Separate compartment for emergency equipment
- Internal finish to allow for steam cleaning
- International hazard sign displayed

or: bulk container to be lifted on vehicle

- Used for storage and replaced when full

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3.10 Workshop 3
Minimization, segregation and handling

Answer in group discussion the following questions:

1) How would you minimize waste in your health-care establishment?

2) Do you carry out any form of recycling in your health-care e stablishment? If yes, describe the recycling that takes place including the types of material, the methods, the markets for the materials and the related savings.

3) Could additional recycling opportunities be identified in your establishment?

4) Are segregation practices currently included in your country-s regulations? Describe.

5) Is health-care waste segregated in your establishment? Could the segregation practices be improved? Outline principles for improved segregation.

6) What would you include in the specifications for a off-site vehicle for health-care in your country?

3.11 Lecture 7
Treatment and disposal options (I)

Overheads

Overhead 7.1 Treatment and disposal options (I)
Overhead 7.2 Criteria for choice of options
Overhead 7.3 Treatment and disposal options for waste
Overhead 7.4 Incineration
Overhead 7.5 Wastes *not* to be incinerated
Overhead 7.6 Types of incinerators
Overhead 7.7 Incinerator applications
Overhead 7.8 HCW incineration in municipal incinerators
Overhead 7.9 Simple field incinerators
Overhead 7.10 Incineration of HCW - some advantages and disadvantages

Teacher's notes

Handouts

Handout 7.1 Bailleul single chamber incinerator and drum incinerator
Handout 7.2 Characteristics of different types of incinerators
Reduced overheads

Treatment and disposal options (I)

Aim of treatment and disposal:

Limit public health and environment impacts by

- transforming the waste into non-hazardous residues by treatment
- containing the waste/ residues to avoid human exposure
- containing the waste/ residues to avoid dispersion into the environment.

Criteria for choice of options

- Prevailing regulations
- Available options in the region
- Quantities of generated waste categories
- Availability of qualified personnel
- Technologies available on the market
- Available options for final disposal
- Environmental aspects
- Available space on hospital premises
- Related cost

etc.

Treatment and disposal options for waste

Treatment

- Incineration
- Chemical disinfection
- Autoclaving
- Encapsulation
- Microwave irradiation etc.

Final disposal

- Municipal landfill
- Burying inside premises
- Discharge into sewer etc.

Overhead 7.4

Incineration

- Reduces organic and combustible waste to inorganic incombustible waste (ashes)
- Reduces significantly waste volume and weight
- Residues are transferred to final disposal site
- Treatment efficiency depends on incineration temperature and type of incinerator
- Not all wastes can be incinerated
- Investment and operation costs vary greatly according to type of incinerator
- Produces combustion gases

Wastes *not t*o be incinerated

- Pressurized gas containers
- Large amounts of reactive chemical waste
- Radioactive waste
- Silver salts or radiographic waste
- Halogenated plastics (e.g. PVC)
- Mercury or cadmium
- Ampoules of heavy metals

Types of incinerators

- **Rotary Kilns**

  1200°C to 1600°C

- **Double chamber pyrolitic incinerators**

  Burning Temperature 800C-900°C

- **Single chamber furnaces with static grate**

  300°C- 400°C

- **Simple field incinerators**

  <300°C

Incinerator applications

- Municipal incinerators
- Incinerators for industrial waste
- On-site incinerators

  (on hospital premises)
- Regional incinerators
- Furnaces for industrial application

  (e.g. cement industry)

HCW incineration in municipal incinerators

- Check packaging on delivery to plant
- Special incinerator loading required
- Should NOT be placed in bunker
- Automatic loading devices recommended
- Not longer than 24 hour storage
- Only introduce HCW when regular combustion conditions established
  (not during start-up phase)

Simple field incinerators

Simple one chamber incinerator with manual operation; can be constructed of:

- Steel drums
- Sheet metal
- Clay
- Brick or concrete

Should be used as a last resort

Requires adequate fuel and good air supply

Incineration of HCW - Some advantages and disadvantages

Advantages:

- Good disinfection efficiency
- Drastic reduction of weight and volume

Disadvantages

- Efficiency of chemical + pharmaceutical waste treatment good for rotary kiln, ~95% for pyrolytic incinerator, very limited for lower temperatures
- Toxic emission to air if no control devices
- Maintaining temperature levels (and efficiency) in field incinerators is difficult
- Usually high costs for high temperature incineration

Teacher=s notes - Lecture 7

Overhead 7.1

Numerous factors should be taken into account when choosing a treatment and/or disposal option. Before purchasing a technology, long-term operation and maintenance aspects should be considered. It is also important to consider the possibilities for final disposal options for the residues.

Overhead 7.2

The choice of the treatment and disposal technology depends on a large number of mainly local criteria. All these should be taken into account carefully. Therefore, it is not possible to recommend one Abest@ option, as it may not be applicable locally.

Overhead 7.3

These are a number of options for the treatment and disposal of health-care waste, which will be discussed in more detail during this course. Many technologies or methods have been developed recently and new technologies will still be developed. These are the main technologies applied at the time of production of this guide (1998).

Overhead 7.5

It should be kept in mind that some wastes should not be incinerated, due to danger of explosion in the incinerator or the generation of toxic emissions into the atmosphere. Explosions of the incinerator will cause break-downs and will require sometimes expensive reparations. This would require segregation of certain wastes.

Overhead 7.6

Rotary kilns are the top of the range and can deal with most types of health-care wastes.
A Bailleul single chamber incinerator and a drum incinerator (a simple field incinerator) are reproduced on Handout 7.1. Some characteristics of these incinerator types are listed in Handout 7.2*(discuss with the participants)*.

Overhead 7.7

According to the local situation and availabilities, hazardous health-care waste may be incinerated on-site, in regional facilities, or even in high-temperature industrial applications.

Overhead 7.8

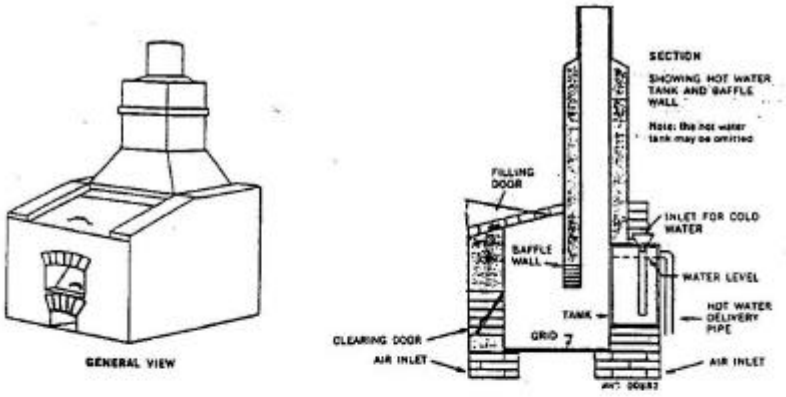
Using Municipal Incinerators should always be considered first as an option if one is available. However, certain precautions must be taken to prevent human exposure and to ensure that the waste is efficiently treated.

Handout 7.1

Bailleul single chamber incinerator and drum incinerator

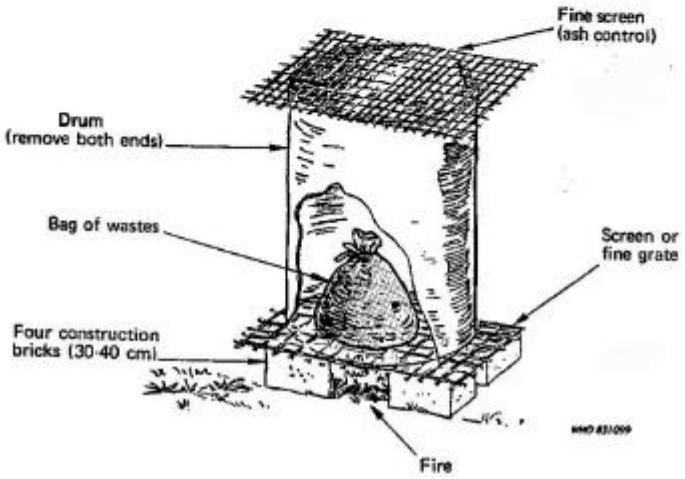
Bailleul single chamber incinerator

Source: Christen/SKAT, 1996



Drum incinerator

Source: Dunsmore, 1986



Handout 7.2

Characteristics of different types of incinerators

	Single chamber incinerator	**Pyrolytic double chamber incinerator**	**Rotary kiln**
Capacity	100-200 kg per day	200-10'000 kg per day	500-3000 kg per day
Temperature	300-400°C	800-900°C	1200-1600°C
Exhaust gas cleaning	difficult to install	usually installed for larger plants	required
Personnel	Training of operatives needed	Well trained personnel requires	Highly trained personnel required
Costs	reasonably low for investment and operation	relatively high for investment and maintenance	High

Reduced overheads - Lecture 7

Overhead 7.1

Treatment and disposal options (I)

Aim of treatment and disposal:

Limit public health and environment impacts by

- transforming the waste into non-hazardous residues by treatment
- containing the waste/ residues to avoid human exposure
- containing the waste/ residues to avoid dispersion into the environment.

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Overhead 7.2

Criteria for choice of options

- Prevailing regulations
- Available options in the region
- Quantities of generated waste categories
- Availability of qualified personnel
- Technologies available on the market
- Available options for final disposal
- Environmental aspects
- Available space on hospital premises
- Related cost

etc.

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Overhead 7.3

Treatment and disposal options for waste

Treatment

- Incineration
- Chemical disinfection
- Autoclaving
- Encapsulation
- Microwave irradiation etc.

Final disposal

- Municipal landfill
- Burying inside premises
- Discharge into sewer etc.

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Overhead 7.4

Incineration

- Reduces organic and combustible waste to inorganic incombustible waste (ashes)
- Reduces significantly waste volume and weight
- Residues are transferred to final disposal site
- Treatment efficiency depends on incineration temperature and type of incinerator
- Not all wastes can be incinerated
- Investment and operation costs vary greatly according to type of incinerator
- Produces combustion gases

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Overhead 7.5

Wastes *not to* be incinerated

- Pressurized gas containers
- Large amounts of reactive chemical waste
- Radioactive waste
- Silver salts or radiographic waste
- Halogenated plastics (e.g. PVC)
- Mercury or cadmium
- Ampoules of heavy metals

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Overhead 7.6

Types of incinerators

- **Rotary Kilns**
  1200°C to 1600°C
- **Double chamber pyrolitic incinerators**
  Burning Temperature 800C-900°C
- **Single chamber furnaces with static grate**
  300°C- 400°C
- **Simple field incinerators**
  <300°C

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Reduced overheads - Lecture 7

Overhead 7.7

Incinerator applications

- Municipal incinerators
- Incinerators for industrial waste
- On-site incinerators
  (on hospital premises)
- Regional incinerators
- Furnaces for industrial application
  (e.g. cement industry)

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Overhead 7.8

HCW incineration in municipal incinerators

- Check packaging on delivery to plant
- Special incinerator loading required
- Should NOT be placed in bunker
- Automatic loading devices recommended
- Not longer than 24 hour storage
- Only introduce HCW when regular combustion conditions established
  (not during start-up phase)

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Overhead 7.9

Simple field incinerators

Simple one chamber incinerator with manual operation; can be constructed of:

- Steel drums
- Sheet metal
- Clay
- Brick or concrete

Should be used as a last resort

Requires adequate fuel and good air supply

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Overhead 7.10

Incineration of HCW - Some advantages and disadvantages

Advantages:

- Good disinfection efficiency
- Drastic reduction of weight and volume

Disadvantages

- Efficiency of chemical + pharmaceutical waste treatment good for rotary kiln, ~95% for pyrolytic incinerator, very limited for lower temperatures
- Toxic emission to air if no control devices
- Maintaining temperature levels (and efficiency) in field incinerators is difficult
- Usually high costs for high temperature incineration

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3.12 Lecture 8
Treatment and disposal options (II)

Overheads

Overhead 8.1 Simple chemical disinfection
Overhead 8.2 Commercial chemical disinfection systems
Overhead 8.3 Wet thermal treatment systems
Overhead 8.4 Screw feed technology
Overhead 8.5 Microwave irradiation
Overhead 8.6 Disposal to land
Overhead 8.7 Landfilling in municipal landfills
Overhead 8.8 Burying inside hospital premises
Overhead 8.9 Disposal to land by encapsulation
Overhead 8.10 Inertization

Teacher-s notes

Handouts

Handout 8.1
Reduced overheads

Simple chemical disinfection

Treatment by contact to commonly used products for surface disinfection

- Requires shredding of waste
- May introduce strong chemicals into the environment
- Efficiency depends on operational conditions
- Only the surface is disinfected
- Human tissue should usually not be disinfected
- Special disposal required to avoid pollution of the environment

Commercial chemical disinfection systems

Several self-contained, fully automatic systems are available on the market, containing several operations, such as

- shredding of the waste
- chemical treatment
- encapsulation

Possible advantages:

- Landfilling of residues
- Environmentally friendly
- Easy to operate

Possible disadvantages:

- Requires specialized operators for maintenance
- May be expensive

Wet thermal treatment systems

Method that exposes waste to steam under pressure

Examples:

autoclaving, larger off-site treatment facilities

Characteristics:

- Low investment and operating costs for simple apparatus
- Environmentally friendly
- Not appropriate for tissue or carcasses
- Trained operatives required

Screw feed technology

Continuous dry thermal process

- Waste is shredded to particle size of 25mm first
- Waste rotates through hot auger:
  - Oil circulates in central shaft at 110-140°
  - 20 minutes retention in system
- Waste Reduction
  - 80% Volume
  - 30% Weight
- Air & water emissions must be treated

Microwave irradiation

- Waste is shredded
- Waste is humidified for homogeneous heating
- Microwaves rapidly heat the waste
- Microbiological inactivation by heat conduction and radiation
- Routine microbiological testing required
- Waste is compacted for landfill

Disposal to land

Not recommended for untreated hazardous waste

Minimum requirements for land disposal:

- No deposit on open dumps
- A degree of management control is exercised
- Engineered avoid leaching to water bodies and retain waste on site
- Rapid burial of HCW on site to isolate from animal or human contact

Landfilling in municipal landfills

In case hazardous health-care waste cannot be treated or disposed elsewhere:

- Within the site, establish a designated place for hazardous HCW
- Limit access to this place
- Bury the waste rapidly to avoid human or animal contact
- Investigate more suitable treatment methods

Burying inside hospital premises

For remote locations and temporary encampments

Apply the following rules:

- Access to the site restricted and controlled
- Site lined with low permeable material
- Only hazardous HCW to be buried
- Each deposit covered with soil
- Groundwater pollution must be avoided

Disposal to land by encapsulation

Fill metal or plastic containers to 3/4 with waste and fill up with:

- plastic foam
- bituminous sand
- cement mortar
- clay material

When dry, seal containers and landfill to restrict access to and reduce mobilization of hazardous substances;

May be used for sharps, chemicals, drugs etc.

Inertization

Method:

- Remove Packaging
- Grind material (Road Roller)
- Add Water Lime and Cement
- Then, either
    - when dry, store or landfill, or
    - when wet, decant into municipal waste in landfill

For chemical and pharmaceutical waste and incinerator ashes

Teacher-s notes - Lecture 8

Overhead 8.1

Distribute Handout 8.1 summarizing advantages and drawbacks of treatment and disposal methods.
Though incineration has been the preferred method for many years, and is still the most widely used treatment option for health-care waste, numerous alternative processes are being developed and should be considered.
Chemical disinfection is used routinely in health care to clean certain instruments and equipment, floors and walls. It has more recently been extended to healthcare waste. Waste is disinfected by the addition of chemicals that kill or inactivate the pathogens contained in the waste.
It is mostly suitable to treat liquid waste such as blood, urine, stools or hospital sewage.
Refer to advantages and drawbacks of simple chemicaldisinfection summarized on Handout 8.1.

Overhead 8.2

Several systems of this type are already available on the market and have been approved by several authorities.

Overhead 8.3

Wet thermal treatment technologies range from the well known and small scale autoclave, commonly used in health-care facilities, to specifically developed large scale facilities. More and more off-site facilities are currently being constructed. The big advantage of this method in comparison to incineration is the absence of emission of combustion gases.

Overhead 8.4

This process is already in use in several hospitals. It should not be used to treat pathological waste.

Overhead 8.6

Untreated hazardous health-care waste should not be landfilled. It should only be done as a last resort if there is no other possibility at the moment. Landfilling is better than leaving hazardous HCW accumulated at hospitals or in other publicly accessible places. More suitable treatment methods should immediately be envisaged.
Residues of treated health-care waste, which are not infectious anymore, may be landfilled.

Overhead 8.8

In health-care establishments applying minimal programmes for health-care waste management, particularly in remote locations, temporary refugee encampments or areas experiencing exceptional hardship, the safe burying inside the hospital premises may be the only credible option available at the

present time. Where this cannot be avoided, there should still be some basic rules set up by the hospital management.

Overhead 8.9

This process is cheap, safe and very appropriate to establishments that cannot envisage other methods to treat sharps, chemical and pharmaceutical waste. Encapsulation is not recommended for non-sharp infectious waste. It may be used in combination with oven burning of non-sharp infectious waste. The main advantages of encapsulation are to prevent even more effectively the risk of scavengers getting access to the landfilled waste and to reduce moblilization of toxic substances.

Overhead 8.10

This method consists in mixing the wastes with cement and other substances in order to dispose of them without major risk of mobilization of the toxic substances contained in the waste into ground or surface waters. It is especially suited for pharmaceuticals or incineration ashes with high metal content. Typical Ratios would be 65% pharmaceutical waste, 15% lime, 15% cement, 5% water.

Handout 8.1: Summary of main advantages and drawbacks of treatment and disposal option

Treatment/ Disposal method	Advantages	Drawbacks
Rotary kiln	Adequate for all infectious waste, chemical and pharmaceutical waste.	High investment and operating costs.
Pyrolytic incineration	Very high disinfection efficiency; Adequate for all infectious waste, and most pharmaceutical and chemical waste.	Destruction of cytotoxics not complete; Relatively high costs of investment and operation.
Single chamber incineration	Good disinfection efficiency; Drastic reduction of weight and volume of waste; The residues may be landfilled; No need for highly qualified operators; Relatively low investment and operation costs.	Generation of significant emissions of atmospheric pollutants Need for periodic slag and soot removal; Inefficiency in destruction of thermally resistant chemicals and drugs such as cytotoxics.
Drum or brick incinerator	Drastic reduction of weight and volume of the waste; Very low investment and operating costs.	Only 99% destruction of microorganisms; No destruction of many chemicals and pharmaceuticals; Massive emission of black smoke, flying ashes, toxic flue gas and odours.
Chemical disinfection*	Highly efficient disinfection good operating conditions; Some chemical disinfectants are relatively inexpensive; Drastic reduction in waste volume.	Requirement of highly qualified technicians for operation of the process; Use of hazardous substances which require comprehensive safety measures; Inadequate for pharmaceutical, chemical and some types of infectious waste.
Wet thermal treatment*	Environmentally friendly; Drastic reduction in waste volume; Relatively low investment and operation costs.	Shredding are subjected to many breakdowns and bad functioning; Operation requires qualified technicians; Inadequate for anatomic waste, pharmaceutical and chemical waste or waste which are not easily penetrable by steam.
Microwave irradiation	Good disinfection efficiency under appropriate operational conditions; Drastic reduction in waste volume; Environmentally friendly.	Relatively high investment and operation costs; Potential operation and maintenance problems.
Encapsulation	Simple and safe; Low costs; May also be applied to pharmaceuticals;	Not recommended for non-sharp infectious waste.
Safe burying	Low costs; Relatively safe if access restricted and where natural infiltration is limited.	Only safe if access to site is limited and some precautions taken;
Inertization	Relatively inexpensive.	Not applicable to infectious waste.

*This table may not apply to more sophisticated, self-contained commercialized methods.

Reduced overheads - Lecture 8

Overhead 8.1

Simple chemical disinfection

Treatment by contact to commonly used products for surface disinfection

- Requires shredding of waste
- May introduce strong chemicals into the environment
- Efficiency depends on operational conditions
- Only the surface is disinfected
- Human tissue should usually not be disinfected
- Special disposal required to avoid pollution of the environment

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Overhead 8.2

Commercial chemical disinfection systems

Several self-contained, fully automatic systems are available on the market, containing several operations, such as

- shredding of the waste
- chemical treatment
- encapsulation

Possible advantages:
- Landfilling of residues
- Environmentally friendly
- Easy to operate

Possible disadvantages:
- Requires specialized operators for maintenance
- May be expensive

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Overhead 8.3

Wet thermal treatment systems

Method that exposes waste to steam under pressure

Examples:

autoclaving, larger off-site treatment facilities

Characteristics:

- Low investment and operating costs for simple apparatus
- Environmentally friendly
- Not appropriate for tissue or carcasses
- Trained operatives required

World Health Organization

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Overhead 8.4

Screw feed technology

Continuous dry thermal process

- Waste is shredded to particle size of 25mm first
- Waste rotates through hot auger:
  - Oil circulates in central shaft at 110-140°
  - 20 minutes retention in system
- Waste Reduction
  - 80% Volume
  - 30% Weight
- Air & water emissions must be treated

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Overhead 8.5

Microwave irradiation

- Waste is shredded
- Waste is humidified for homogeneous heating
- Microwaves rapidly heat the waste
- Microbiological inactivation by heat conduction and radiation
- Routine microbiological testing required
- Waste is compacted for landfill

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Overhead 8.6

Disposal to land

Not recommended for untreated hazardous waste

Minimum requirements for land disposal:

- No deposit on open dumps
- A degree of management control is exercised
- Engineered avoid leaching to water bodies and retain waste on site
- Rapid burial of HCW on site to isolate from animal or human contact

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Overhead 8.7

Landfilling in municipal landfills

In case hazardous health-care waste cannot be treated or disposed elsewhere:

- Within the site, establish a designated place for hazardous HCW
- Limit access to this place
- Bury the waste rapidly to avoid human or animal contact
- Investigate more suitable treatment methods

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Overhead 8.8

Burying inside hospital premises

For remote locations and temporary encampments

Apply the following rules:

- Access to the site restricted and controlled
- Site lined with low permeable material
- Only hazardous HCW to be buried
- Each deposit covered with soil
- Groundwater pollution must be avoided

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Overhead 8.9

Disposal to land by encapsulation

Fill metal or plastic containers to 3/4 with waste and fill up with:

- plastic foam
- bituminous sand
- cement mortar
- clay material

When dry, seal containers and landfill to restrict access to and reduce mobilization of hazardous substances;

May be used for sharps, chemicals, drugs etc.

World Health Organization

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Overhead 8.10

Inertization

Method:

- Remove Packaging
- Grind material (Road Roller)
- Add Water Lime and Cement
- Then, either
  - when dry, store or landfill, or
  - when wet, decant into municipal waste in landfill

For chemical and pharmaceutical waste and incinerator ashes

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3.13 Lecture 9
Application of treatment and disposal methods to health-care waste categories

Overheads

Overhead 9.1	Infectious waste and sharps
Overhead 9.2	Pharmaceutical waste
Overhead 9.3	Cytotoxic waste
Overhead 9.4	Chemical waste
Overhead 9.5	Chemical waste - further recommendations
Overhead 9.6	Wastes with high heavy metal content
Overhead 9.7	Pressurized gas containers
Overhead 9.8	Radioactive waste

Teacher's notes

Lecture Handouts

Handout 9.1 Overview of disposal and treatment methods suitable for health-care waste categories
Reduced overheads

Infectious waste and sharps

- Systems should be chosen according to national and local situation
- Nearly all mentioned treatment systems are suitable for infectious waste except encapsulation (which can be used for sharps) and inertization
- Highly infectious waste (from laboratories) should be autoclaved first

Pharmaceutical waste

Small amounts:

- Disperse in landfill sites
- Encapsulate
- Bury on site
- Discharge to sewer
- Incinerate

Large amounts

- Incineration at high temperatures
- Encapsulation
- ***LANDFILL IS NOT RECOMMENDED***

Cytotoxic waste

NEVER **LANDFILL or DISPOSE TO SEWER**

Disposal Options

- Return to supplier
- Incinerate at high temperature
- Chemical degradation

Chemical waste

Small amounts

- Disperse in landfill sites
- Encapsulate
- Bury on site
- Discharge to sewer
- Incinerate

Large amounts

- Incineration for certain combustible wastes
- Return to original supplier
- May be exported to a site for proper treatment
- LANDFILL IS NOT RECOMMENDED

Chemical waste - further recommendations

- Different hazardous chemicals must be kept separate
- Hazardous chemicals should not be disposed of to the sewer
- Large amounts of disinfectants should not be encapsulated as they are corrosive and sometimes inflammable
- Large amounts of chemicals should not be buried

Wastes with high heavy metal content

Wastes containing mercury, cadmium etc.

(e.g. thermometers, batteries)

- Should never be incinerated or burnt
- Should never be disposed of in municipal landfills
- Best solution: recovery in specialized cottage industry
- Export to countries with specialized facilities
- Encapsulation

Pressurized gas containers

MUST *NEVER* BE INCINERATED

- Undamaged gas cylinders and cartridges should be returned to the manufacturer for reuse
- Damaged containers after being completely emptied can be crushed and disposed of to landfill
- Aerosol cans can be collected with household waste if not being incinerated

Radioactive waste

Management and disposal requires a national strategy and infrastructure, including

- Appropriate legislation
- A competent regulatory organization
- Radiation protection officer
- Trained personnel

Safe handling and disposal of radioactive waste requires a rigorous and relatively complex management scheme

Teacher=s notes - Lecture 9

Overhead 9.1

An overview of disposal and treatment methods suitable for the different health-care waste categories is provided in Handout 9.1.

Overhead 9.3

Due to its highly hazardous nature, cytotoxic waste should never be landfilled or disposed to the sewer. Wherever possible, safely package the outdated drugs or which are no longer needed and return to the supplier. (Cytotoxic means possessing a specific destructive action on certain cells; e.g. substances used for treatment of cancer patients).
Chemical degradation methods have been developed by the International Agency for Research on Cancer, Lyon, France, of the World Health Organization.

Overhead 9.4

There is no safe and cheap way to dispose of significant quantities of hazardous chemical waste. Significant quantities of hazardous waste should be disposed of by the most appropriate means according to the nature of the hazard presented by the waste.
Incineration of large quantities of halogenated solvents (e.g. containing chlorine or fluorine) should not be practised in facilities without adequate gas-cleaning equipment. Any waste which cannot be safely and efficiently incinerated should be handled and disposed of by an authorized hazardous waste management organization or company. This organization or company may eliminate these wastes in a rotary kiln, treat them chemically, or store them in a safe disposal place engineered for hazardous chemicals.
Other possibilities may also be envisaged: Return to the original supplier, who should be organized to dispose of them safely. In this case, appropriate provisions should be included in the original purchase contract for the chemicals. Also, the waste could be exported to a country which has the expertise and facilities to dispose safely of hazardous waste. In this case, the shipment should comply with international agreements, such as the previously mentioned Basel Convention. It may also be considered to use certain products for non-medical purposes, e.g. expired cleaning disinfectants to clean toilets.

Overhead 9.5

Non-hazardous, non-recyclable chemical waste (such as sugars, amino acids, certain salts) may be disposed of together with municipal waste or discharged to the sewer.

Overhead 9.6

Incineration or burning may lead to toxic emissions of heavy metals to the atmosphere. Disposal to landfills may result into pollution of the groundwater.
In countries where specialized cottage industries for the recovery of heavy metals exist, the best solution is to send them the mercury and/or cadmium loaded waste for recovery of these valuable materials.

Exporting the waste to a country with the expertise and facilities to adequately treat this waste should also be envisaged.
If none of the above options are feasible, the wastes may alternatively be disposed of in a safe storage site especially designed for the final disposal of hazardous industrial waste. Establishments applying minimal programmes of waste management may also consider encapsulation, followed by disposal in an impermeable landfill if available.

Overhead 9.7

Incineration or burning is not a disposal option for pressurized containers or aerosol cans and may be dangerous due to the risk of explosion.

Overhead 9.8

The issue of radioactive waste management will not be addressed in more detail in this course, as it is relatively complex.
Each hospital or laboratory using unsealed radioactive sources for diagnosis, therapy or research purposes should designate a trained radiation protection officer who will be responsible for the safe use of radioactive substances and record keeping. A proper record system for transfer or disposal of radioactive waste should be established and kept.

Handout 9.1 Overview of disposal and treatment methods suitable for health-care waste categories

Technology or method	Infectious waste	Anatomic waste	Sharps	Pharmaceutical waste	Cytotoxic waste	Chemical waste	Radioactive waste
Rotary kiln	yes	yes	yes	yes	yes	yes	low-level infectious waste
Pyrolytic incinerator	yes	yes	yes	small quantities	no	small quantities	low-level infectious waste
Single chamber incinerator	yes	yes	yes	no	no	no	low-level infectious waste
Drum or brick incinerator	yes	yes	yes	no	no	no	no
Chemical disinfection	yes	no	yes	no	no	no	no
Wet thermal treatment	yes	no	yes	no	no	no	no
Microwave irradiation	yes	no	yes	no	no	no	no
Encapsulation	no	no	yes	yes	small quantities	small quantities	no
Safe burying inside premises	yes	yes	yes	small quantities	no	small quantities	no
Sanitary landfill	yes	no	no	small quantities	no	no	no
Discharge to the sewer	no	no	no	small quantities	no	no	low-level liquid waste
Inertization	no	no	no	yes	yes	no	no
Other methods				return expired drugs to supplier	return expired drugs to supplier	return unused chemicals to supplier	decay by storage

Reduced overheads - Lecture 9

Overhead 9.1

Infectious waste and sharps

- Systems should be chosen according to national and local situation
- Nearly all mentioned treatment systems are suitable for infectious waste except encapsulation (which can be used for sharps) and inertization
- Highly infectious waste (from laboratories) should be autoclaved first

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Overhead 9.2

Pharmaceutical waste

Small amounts:

- Disperse in landfill sites
- Encapsulate
- Bury on site
- Discharge to sewer
- Incinerate

Large amounts

- Incineration at high temperatures
- Encapsulation
- ***LANDFILL IS NOT RECOMMENDED***

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Overhead 9.3

Cytotoxic waste

NEVER **LANDFILL or DISPOSE TO SEWER**

Disposal Options

- Return to supplier
- Incinerate at high temperature
- Chemical degradation

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Overhead 9.4

Chemical waste

Small amounts

- Disperse in landfill sites
- Encapsulate
- Bury on site
- Discharge to sewer
- Incinerate

Large amounts

- Incineration for certain combustible wastes
- Return to original supplier
- May be exported to a site for proper treatment
- LANDFILL IS NOT RECOMMENDED

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Overhead 9.5

Chemical waste - further recommendations

- Different hazardous chemicals must be kept separate
- Hazardous chemicals should not be disposed of to the sewer
- Large amounts of disinfectants should not be encapsulated as they are corrosive and sometimes inflammable
- Large amounts of chemicals should not be buried

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Overhead 9.6

Wastes with high heavy metal content

Wastes containing mercury, cadmium etc.

(e.g. thermometers, batteries)

- Should never be incinerated or burnt
- Should never be disposed of in municipal landfills
- Best solution: recovery in specialized cottage industry
- Export to countries with specialized facilities
- Encapsulation

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Reduced overheads - Lecture 9

Overhead 9.7

Pressurized gas containers

MUST *NEVER* BE INCINERATED

- Undamaged gas cylinders and cartridges should be returned to the manufacturer for reuse
- Damaged containers after being completely emptied can be crushed and disposed of to landfill
- Aerosol cans can be collected with household waste if not being incinerated

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Overhead 9.8

Radioactive waste

Management and disposal requires a national strategy and infrastructure, including

- Appropriate legislation
- A competent regulatory organization
- Radiation protection officer
- Trained personnel

Safe handling and disposal of radioactive waste requires a rigorous and relatively complex management scheme

World Health Organization

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3.14 Workshop 4
Treatment and disposal options

A) For participants from national or local authorities

Evaluate the treatment and disposal options that would be suitable for health-care waste in your country and prepare a policy. Differentiate the policy for large hospitals and for smaller, remote health-care establishments. Take into account the aspects listed below.

B) For participants from health-care establishments

Evaluate the treatment and disposal options that would be suitable for health-care waste in your health-care establishment and propose a strategy. Formulate a strategy for larger hospitals and smaller, remote health-care establishments. Take into account the following aspects:

- Public health and safety, including worker's safety
- Existing options in the country/ region
- Different health-care waste categories
- Availability of qualified personnel
- Technologies available on the market
- Environmental aspects
- Approximate investment and operational costs
- Required training to operate the technologies
- Maintenance requirements
- On-site versus off-site options
- Acceptability by the general public

etc.

3.15 Lecture 10
Wastewater management

Overheads

Overhead 10.1 Wastewater from health-care establishments
Overhead 10.2 Wastewater discharge to municipal sewer
Overhead 10.3 On-site treatment of wastewater
Overhead 10.4 On-site sludge treatment
Overhead 10.5 On-site minimal safety requirements
Overhead 10.6 Sanitation in health-care establishments

Teacher=s notes

Handouts

Reduced overheads

Wastewater from health-care establishments

May contain

- **Microbiological pathogens**
  - Bacteria
  - Viruses
  - Helminths
- **Hazardous chemicals**
- **Pharmaceuticals**
- **Radioactive isotopes**

Wastewater discharge to municipal sewer

Hospitals may use a sewer providing:

- The sewer is connected to a plant removing 95% of bacteria
- Sludge is anaerobically digested to a standard of <one helminth egg per litre
- High standards of HCW management and low discharge of hazardous chemicals
- Waste from patients treated with cytotoxic drugs is collected separately

On-site treatment of wastewater

- **Primary treatment**
- **Secondary biological purification**
  - 90% to 95% of bacteria removed
  - Most helminths removed
- **Tertiary treatment**
  - Lagooning or sand filter
  - <10 mg/l suspended organic matter
- **Chlorine disinfection**
  - Especially important if effluent discharged in a coastal area

On-site sludge treatment

Options

- Anaerobic digestion
- Natural drying in beds, and incineration

Guidelines for safe land spreading without disinfection

- <one helminth egg per kilogram
- <1000 faecal coliform per 100 grammes

On-site minimal safety requirements

Lagooning

- Two lagoons (minimum) followed by soil filtration

If no sewage treatment:

- Isolate enteric patients and disinfect excreta
- No discharge of chemicals and pharmaceuticals to the sewer
- Deshydrate sludges from hospital cesspools and disinfect chemically
- NEVER use hospital sewage for agriculture
- Don’t discharge to natural waters
- Small rural establishments: infiltrate through porous soil

Sanitation in health-care establishments

Hospital sanitation is of

primary importance

to avoid the continuous recirculation of diseases in the community

Teacher-s notes - Lecture 10

Overhead 10.1

Sewage from health-care establishments is of a quality similar to urban sewage, but may in addition include various potentially hazardous components, listed on the overhead.
Of main concern are wastewaters with a high content of enteric pathogens easily transmitted through the water cycle; these are produced by wards treating patients with enteric diseases (mainly contained inpatient-s excreta), in particular during outbreaks ofdiarrhoeal disease.
Possible links between unsafe wastewater disposal of health-care establishments have been strongly suspected in relation to major outbreak spreads (e.g. cholera outbreaks).
Sewer networks of the health-care establishments are not always connected to an efficiently operated sewage treatment plant, and sometimes municipal sewer networks may not even exist.

Overhead 10.2

Discharge to the municipal sewer is possible if the health-care waste management system of the establishment reaches high standards, ensuring the absence of significant quantities of toxic chemicals, pharmaceuticals and radionuclides, and cytotoxic drugs and antibiotics in the discharged sewage; also, in oncological wards, excreta from patients under treatment with cytotoxic drugs should be collected separately and adequately treated as the othercytotoxic waste.
Chemical pollutants contained in hospital wastewater may have toxic effects on the active bacteria of the municipal sewage purification processes which may cause a problems regarding the good functioning of the sewage treatment plant.

Overhead 10.3

Many hospitals have their own sewage treatment plant, in particular when the hospital is not connected to any municipal treatment plants. Efficient treatment of sewage from health-care establishments should include the operations outlined on the overhead.
Secondary treatment will usually remove a significant part ofhelminths, bacteria and viruses.
Tertiary treatment should reduce the suspended organic matter to far less than 10 mg/l. For reaching pathogen concentrations comparable to those found in natural waters, chlorine disinfection should be made.

Overhead 10.4

The sludge resulting from hospital sewage treatment will contain high concentrations ofhelminths and other pathogens.
Reuse of wastewater andsludges in agriculture andaquaculture:
According to the relevant WHO guidelines, the treated wastewater should not contain more than one helminth egg per litre and no more than 1000 faecalcoliforms per 100 millilitres for unrestricted irrigation. It is essential that the treated sludge does not contain more than one helminth egg per kilogram and no more than 1000 faecalcoliforms per 100 grams. Furthermore, the sludge should be applied to the fields in trenches and covered with soil.

Overhead 10.5

There is no safe solution for the disposal of sewage from hospitals which are not connected to a sewer, are unable to afford a compact sewage treatment plant, and have no space available to build a lagooning system.

Establishments which cannot afford sewage treatment plants should use a lagooning system. The lagooning system should comprise two successive lagoons to achieve an acceptable level of purification of their hospital sewage. This lagooning system may eventually be followed by land infiltration of the effluent to benefit from the soil filtrating capacity.

Minimal safety requirements should be taken by establishments with minimal programmes, unable to afford any sewage treatment to minimize health risks (see overhead).

Small-scale rural health-care establishments applying minimal waste management programmes may discharge their wastewater to the environment. An acceptable solution would be to practice natural filtration of their sewage through infiltration on adequate porous soils, located outside the catchment area of aquifers used to produce drinking water or to supply water to the hospital.

Overhead 10.6

In many of the health-care establishments of developing countries, patients have no access to sanitation. This means that excreta, are usually spread out to the environment, creating a high risk of infection to people who come in direct or indirect contact with it. Human excreta are the principal vehicle for the transmission and spread of a wide range of communicable diseases. It is, therefore, of primary importance to provide access to adequate sanitation in every health-care establishment. The faecal-oral cycle (and other routes of transmission like penetration through the skin) has to be interrupted to avoid the diseases being continuously recirculated through the population.

The health-care establishment should, if possible, be connected to a sewage system. There also exist technically sound on-site sanitation systems according to the standard technologies in sanitary engineering, which are readily accessible in guidebooks. In addition, convenient washing facilities should be available to all patients personnel and visitors.

Reduced overheads - Lecture 10

Overhead 10.1

Wastewater from health-care establishments

May contain

- **Microbiological pathogens**
  - Bacteria
  - Viruses
  - Helminths
- **Hazardous chemicals**
- **Pharmaceuticals**
- **Radioactive isotopes**

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Overhead 10.2

Wastewater discharge to municipal sewer

Hospitals may use a sewer providing:

- The sewer is connected to a plant removing 95% of bacteria
- Sludge is anaerobically digested to a standard of <one helminth egg per litre
- High standards of HCW management and low discharge of hazardous chemicals
- Waste from patients treated with cytotoxic drugs is collected separately

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Overhead 10.3

On-site treatment of wastewater

- **Primary treatment**
- **Secondary biological purification**
  - 90% to 95% of bacteria removed
  - Most helminths removed
- **Tertiary treatment**
  - Lagooning or sand filter
  - <10 mg/l suspended organic matter
- **Chlorine disinfection**
  - Especially important if effluent discharged in a coastal area

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Overhead 10.4

On-site sludge treatment

Options

- Anaerobic digestion
- Natural drying in beds, and incineration

Guidelines for safe land spreading without disinfection

- <one helminth egg per kilogram
- <1000 faecal coliform per 100 grammes

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Overhead 10.5

On-site minimal safety requirements

Lagooning

- Two lagoons (minimum) followed by soil filtration

If no sewage treatment:

- Isolate enteric patients and disinfect excreta
- No discharge of chemicals and pharmaceuticals to the sewer
- Deshydrate sludges from hospital cesspools and disinfect chemically
- NEVER use hospital sewage for agriculture
- Don't discharge to natural waters
- Small rural establishments: infiltrate through porous soil

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Overhead 10.6

Sanitation in health-care establishments

Hospital sanitation is of primary importance to avoid the continuous recirculation of diseases in the community

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3.16 Lecture 11
Workers= health and safety and emergencies

Overheads

Overhead 11.1	Workers= health and safety - principles
Overhead 11.2	Personal hygiene
Overhead 11.3	Protective clothing
Overhead 11.4	Safe management practices
Overhead 11.5	Programme for response to injuries
Overhead 11.6	Cytotoxic safety
Overhead 11.7	Emergency response - principles
Overhead 11.8	Procedure for spillage cleaning
Overhead 11.9	Reporting incidents

Teacher=s notes

Handouts

Reduced overheads

Workers' health and safety principles

Good occupational health and safety measures include the following points:

- Proper training
- Personal protective clothing and equipment
- Effective occupational health programme
  - immunization
  - post-exposure prophylaxis
  - medical surveillance
- Personal Hygiene

Personal hygiene

- Convenient washing facilities (with warm water and soap) should be available for personnel handling hazardous HCW

- Personnel should be trained on personal hygiene issues that reduce the risk from handling hazardous HCW

Protective clothing

- Helmets
- Respiratory face masks
- Eye protectors
- Overalls
- Industrial aprons
- Leg protectors
- Industrial boots
- Disposable gloves (medical staff) or
- Heavy duty gloves (waste workers)

Safe management practices

- Waste segregation
- Appropriate packaging of waste
- Waste identification
- Proper storage of waste
- Adequate transportation

Programme for response to injuries

- Immediate first aid measures
- Immediate reporting
- Identify source of injury
- Obtain additional medical care
- Maintain medical surveillance
- Blood tests if required
- Record the incident in full
- Investigate the causes and report
- Implement prevention measures for similar incidents

Cytotoxic safety

Special measures should be taken when using cytotoxic drugs:

- A specially assigned safety officer should supervise the safe management of these products and wastes
- Set up written procedures for handling products and waste
- Training of the staff about hazards, and handling and decontamination procedures
- Develop emergency programme for spills and accidents

Emergency response - principles

- **Follow the waste management plan**
- **Clean contaminated areas and disinfect if necessary**
- **Limit exposure of workers**
- **Limit impact on:**
  - Patients
  - Personnel
  - Environment

Procedure for spillage cleaning

- Evacuate the area
- Decontaminate eyes and skin
- Inform designated person
- Determine nature of spill
- Provide first aid
- Secure area
- Protective clothing
- Limit the spill
- Neutralize or disinfect
- Collect the spill
- Decontaminate the area
- Rinse the area
- Seek medical care where necessary

Reporting incidents

All incidents including near misses must be notified as follows:

- Description of incident
- Where and when it occurred
- Which staff were involved
- Other relevant circumstances

A report should be made and records should be kept

Teacher-s notes - Lecture 11

Overhead 11.1

Health and safety training should ensure that workers know and understand the potential risks associated with health-care waste, the value ofimmunization, and the importance of using the personal protective equipment and personal hygiene.
Groups of workers at risk include health-care providers, hospital cleaners, maintenance workers, operators of treatment facilities, health-care waste handlers and health-care waste disposal operators in and outside health-care establishments.

Overhead 11.2

Personal hygiene, in particular hand washing, may prevent further spread of pathogens (e.g. ingestion) with which the worker may have come into contact.

Overhead 11.3

The protective clothing listed on the overhead should be used by workers handling health-care waste (only the disposable gloves are for use by medical staff). The overall, aprons, leg protectors or industrial boots and gloves are obligatory, while the use of the other items should depend upon the operations carried out by the worker.
Protective clothing is essential to protect against personal injury.

Overhead 11.4

Many of the practices outlined in the previous lectures of this course contribute toworkers- safety and health protection. The main points are listed on the overhead.
Segregation and waste identification shows the hazards of the content.
Adequate packaging and transportation prevents exposure of workers to the content.
Adequate storage limits the access to unauthorized persons and the access of rodents.

Overhead 11.5

A programme should be established for the response to injuries of personnel. Thisprogramme should be known to all staff. It should include the elements listed on the overhead.
Identifying the source of injury may provide information on possible infections.
Assessing the detailed circumstances of the injury and its causes may suggest measures for the prevention of such accidents in the future.

Overhead 11.6

Due to the special hazards related to exposure tocytotoxic products, special precautions should be taken.
Rural or urban district hospitals of middle and lower income countries do not typically use cytotoxic products.

Overhead 11.7

One person should be designated to be responsible for handling emergencies. This persons has to design a deputy in case of absence.
In health-care establishments the most common emergencies are probably related to the spill of infectious and hazardous substances and wastes. The response to emergencies is based on the principles listed on the overhead.
Staff should be trained for emergency procedures. Written procedures should be established for the different types of emergencies. The necessary tools and materials should be easily accessible at all times.

Overhead 11.8

Usually, spills only require cleaning of the contaminated area. For spills of infectious agents, it may be necessary to evacuate the area, depending on the infectious agents involved. On the overhead is listed an example of procedure to follow after a spill. The actions should follow the order provided on the overhead.
It is essential that contaminated eyes or skin are decontaminated immediately, in general with abundant amounts of water.

Overhead 11.9

The incidents should be reported to the responsible officer who should investigate them. This officer should consider the implementation of preventive measures.

Reduced overheads - Lecture 11

Overhead 11.1

Workers' health and safety principles

Good occupational health and safety measures include the following points:

- Proper training
- Personal protective clothing and equipment
- Effective occupational health programme
  - immunization
  - post-exposure prophylaxis
  - medical surveillance
- Personal Hygiene

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Overhead 11 2

Personal hygiene

- Convenient washing facilities (with warm water and soap) should be available for personnel handling hazardous HCW
- Personnel should be trained on personal hygiene issues that reduce the risk from handling hazardous HCW

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Overhead 11.3

Protective clothing

- Helmets
- Respiratory face masks
- Eye protectors
- Overalls
- Industrial aprons
- Leg protectors
- Industrial boots
- Disposable gloves (medical staff) or
- Heavy duty gloves (waste workers)

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Overhead 11.4

Safe management practices

- Waste segregation
- Appropriate packaging of waste
- Waste identification
- Proper storage of waste
- Adequate transportation

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Overhead 11.5

Programme for response to injuries

- Immediate first aid measures
- Immediate reporting
- Identify source of injury
- Obtain additional medical care
- Maintain medical surveillance
- Blood tests if required
- Record the incident in full
- Investigate the causes and report
- Implement prevention measures for similar incidents

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Overhead 11.6

Cytotoxic safety

Special measures should be taken when using cytotoxic drugs:

- A specially assigned safety officer should supervise the safe management of these products and wastes
- Set up written procedures for handling products and waste
- Training of the staff about hazards, and handling and decontamination procedures
- Develop emergency programme for spills and accidents

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Reduced overheads - Lecture 11

Overhead 11.7

Emergency response - principles

- **Follow the waste management plan**
- **Clean contaminated areas and disinfect if necessary**
- **Limit exposure of workers**
- **Limit impact on:**
  - Patients
  - Personnel
  - Environment

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Overhead 11.8

Procedure for spillage cleaning

- Evacuate the area
- Decontaminate eyes and skin
- Inform designated person
- Determine nature of spill
- Provide first aid
- Secure area
- Protective clothing
- Limit the spill
- Neutralize or disinfect
- Collect the spill
- Decontaminate the area
- Rinse the area
- Seek medical care where necessary

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Overhead 11.9

Reporting incidents

All incidents including near misses must be notified as follows:

- Description of incident
- Where and when it occurred
- Which staff were involved
- Other relevant circumstances

A report should be made and records should be kept

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3.17 Lecture 12
Waste management related costs

Overheads

Overhead 12.1	Principles of costing
Overhead 12.2	Internal and external costs
Overhead 12.3	Total costs of a waste management system
Overhead 12.4	Methods of financing
Overhead 12.5	Use of private services
Overhead 12.6	Contractual arrangements
Overhead 12.7	Cost reduction check list

Teacher=s notes

Lecture Handout

Handout 12.1	Costs of construction and operation of a health-care waste incineration plant

Reduced overheads

Principles of costing

Polluter Pays Principle

- Health-care establishment pays for the safe disposal of the waste it generates

Minimization, segregation and recycling of waste

Appropriate sizing of the waste management system

Anticipate future trends

Internal and external costs

Internal Costs

Segregation, packaging, on-site handling and treatment: costs of supplies and labour.

External Costs

Off-site transport and treatment, final disposal: paid to contractors who provide the service.

Total costs of a waste management system

- **Initial capital investments**
  purchase of equipment
- **Amortization of plant and equipment**
  over life time of equipment
- **Operating costs**
  costs of labour and consumables
- **Contractual costs**
  for external services, e.g. transportation, final disposal

Methods of financing

Public funding of investments

Compulsory use of public facilities

Private funding of investments

Choice of private facilities and services

Funding of investments by the health-care establishment

Use of on-site treatment facility

Funding of investments by several health-care establishments

Cooperation between establishments to use common facility

Use of private services

Advantages:

- Inability of health-care establishments to raise needed capital
- Expected greater efficiency than public facilities
- Transfer of risk for operation

Disadvantages:

- Potential loss of control by the public agency
- May result in minimum level of services provided
- Regular inspection and regulatory control required

Contractual arrangements

Any agreement with private companies should include the following points:

- Prescribe minimal levels of service
  (reliability, safety, public health risks, expansion)
- Method of dealing with cost increases
  (inflation etc.)
- Environmental concerns
- Transfer of ownership
- Quality and regulatory control

Cost reduction check list

- **On-site waste management practices**
  - Waste segregation, minimization and recycling
- **Purchasing policy and stock management**
- **Comprehensive planning**
  - Develop and implement waste management strategy
  - Consider regional cooperation
- **Cost accounting and control**
- **Choose adequate methods and technologies**
- **Training of personnel for efficient and safe implementation**

Teacher=s notes - Lecture 12

Overhead 12.1

According to the >Polluter pays= principle, each health-care establishment should pay for the safe treatment and disposal of the waste it generates.
Before planning a waste management system it should always ensure that the waste is segregated, which will significantly reduce the quantities of hazardous waste requiring special handling, treatment and disposal.
Adequate sizing of all elements of the system will prevent from subsequent costly modifications; Future trends in waste production, and the legislation becoming more stringent, should be anticipated.

Overhead 12.2

The construction, operation and maintenance costs of health-care waste management systems can represent a significant part of the global budget of a health-care establishment. It is essential to consider these costs when planning an establishment.
The internal and external costs of waste management have to be considered by the health-care establishment.

Overhead 12.3

A list of elements that contribute to the costs related to health-care waste management is summarized on Handout 12.1, for the example of an incinerator. It can be adapted for other technologies. This list may not be exhaustive.

Overhead 12.4

For public health-care establishments, general revenues may be used for waste management. The treatment and disposal facilities/sites may be constructed and operated from public or private funding. The national authority may require, by regulations, implementation of on-site treatment, compulsorily use public facilities or allow the choice to use private waste facilities (e.g. in the USA). These regulations may restrict certain disposal options or specify the required treatment technology and standards of operation.
Under arrangements with a private company, a private entity finances, builds, owns and operates for instance the treatment facility and sells the services to health-care establishments for collection and disposal fees. The use of private services should be encouraged, in particular for alternative treatment methods other than incineration.

Overhead 12.5

On the overhead are listed possible advantages and disadvantages that may result from the use of private waste management services including treatment and disposal. The main advantage is usually the increased efficiency resulting from competition among service providers on the market. The reduced level of services refers specifically to reliability, safety, public health risks and environmental aspects.

Also, the private company may increase the service costs due to factors that could not be foreseen (e.g. change of legislation) and which will represent unexpected expenses for the health-care establishment.

Overhead 12.7

Cost reduction measures can be taken at different levels of waste management.
As repeatedly mentioned, the most efficient ways tominimize hazardous health-care waste production are segregation,minimization, in certain cases recycling of wastes, purchase policies and stock management.
Documentation of costs will allow to identify priorities for cost reduction and monitor progress in the achievements of objectives.

Handout 12.1:Costs of construction and operation of a health-care waste incineration plant

Site
Cost of land
Rights of way
Site preparation and infrastructure
Provision of utilities to site

Consultancy fees
Environmental/waste management consultant
Engineering
Architectural
Legal fees

Construction costs
Incinerator building
Waste storage room
Offices

Incinerator
Cost of incinerator
Freight and storage charges

Waste transport costs
Waste collection trucks
Bins/containers for transporting waste from hospitals to incinerator site

Equipment costs
Trolleys for collecting waste bags from wards
Bag holders to be located at all sources of waste arisings in hospitals
Weighing machines for weighing waste bags
Refrigerators for storage of waste if necessary

Financing charges
Interest
Taxes
Accounting and audit fees

Direct operating costs
Manpower requirements (manager, operators, drivers,...)
Yellow bags with tags for infectious wastes
Black bags for non-risk waste
Sharps containers
Transportation costs
Utilities (fuel, water, electricity)
Chemicals (for flue-gas cleaning)

Indirect operating costs
Training
Incinerator maintenance and parts replacement
Vehicle maintenance
Uniforms and safety equipment
Ash disposal cost
Compliance monitoring of flue gas emissions
Project management and administrative costs for the organization responsible for the execution and long-term operation of the project

Total

Estimation of Costs

Overhead 12.1

Principles of costing

Polluter Pays Principle

- Health-care establishment pays for the safe disposal of the waste it generates

Minimization, segregation and recycling of waste

Appropriate sizing of the waste management system

Anticipate future trends

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Overhead 12.2

Internal and external costs

Internal Costs

Segregation, packaging, on-site handling and treatment: costs of supplies and labour.

External Costs

Off-site transport and treatment, final disposal: paid to contractors who provide the service.

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Overhead 12.3

Total costs of a waste management system

- **Initial capital investments**
  purchase of equipment
- **Amortization of plant and equipment**
  over life time of equipment
- **Operating costs**
  costs of labour and consumables
- **Contractual costs**
  for external services, e.g. transportation, final disposal

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Overhead 12.4

Methods of financing

Public funding of investments
Compulsory use of public facilities

Private funding of investments
Choice of private facilities and services

Funding of investments by the health-care establishment
Use of on-site treatment facility

Funding of investments by several health-care establishments
Cooperation between establishments to use common facility

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Overhead 12.5

Use of private services

Advantages:

- Inability of health-care establishments to raise needed capital
- Expected greater efficiency than public facilities
- Transfer of risk for operation

Disadvantages:

- Potential loss of control by the public agency
- May result in minimum level of services provided
- Regular inspection and regulatory control required

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Overhead 12.6

Contractual arrangements

Any agreement with private companies should include the following points:

- Prescribe minimal levels of service
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- Method of dealing with cost increases
  (inflation etc.)
- Environmental concerns
- Transfer of ownership
- Quality and regulatory control

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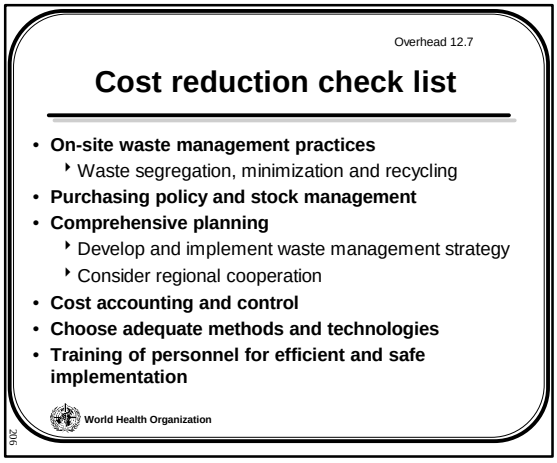
Overhead 12.7
Cost reduction check list
• On-site waste management practices
‣ Waste segregation, minimization and recycling
• Purchasing policy and stock management
• Comprehensive planning
‣ Develop and implement waste management strategy
‣ Consider regional cooperation
• Cost accounting and control
• Choose adequate methods and technologies
• Training of personnel for efficient and safe implementation
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3.18 Lecture 13
Training on HCW management

Overheads

Overhead 13.1	Aims of education and training
Overhead 13.2	Target groups for training
Overhead 13.3	Training programme content
Overhead 13.4	Training for waste management operators
Overhead 13.5	Training for waste transporters
Overhead 13.6	Training for operators of waste treatment facilities
Overhead 13.7	Training for landfill operators

Teacher-s notes

Handouts

Reduced overheads

Aims of education and training

- To make the waste management strategy effective
- To create a competent workforce
- Highlight employees' responsibilities
- To protect employees health and safety

Target groups for training
(health-care establishments)

- Hospital managers and waste managers
- Medical doctors
- Nursing staff
- Hospital cleaners, porters and auxiliary staff

Training programme content

Training should be competence based with hands-on training in simulated real life situations, on the following subjects:

- Health-care waste policy with full justification
- Instructions on individual responsibilities
- Detailed technical instructions on procedures to be followed

Periodical repetition courses will refreshen and update the knowledge

Training for waste management operators

- Information on risks, and health and safety advice
- Competence based training on all handling procedures, including the management of incidents
- Wearing of protective clothing
- Use of safety equipment
- Documentation and record keeping

Training for waste transporters

- Risks related to the transported waste
- Handling, loading and unloading procedures
- Procedures for dealing with spillages
- Wearing of protective clothing
- Equipment of the vehicle
- Documentation and record-keeping procedures

  (e.g. consignment note system)

Training for operators of waste treatment facilities

- Outline of the operation of the facility
- Health and safety related to the operations
- Emergency procedures
- Technical procedures
- Maintenance and record keeping
- Emission control
- Surveillance of residue quality

Training for landfill operators

- Information on health and safety
- Control of scavenging
- Protective clothing and personal hygiene
- Safe procedures for landfilling HCW
- Emergency response measures

Teacher=s notes - Lecture 13

Overhead 13.1

Personnel of health-care establishments and waste workers have a right to be informed about the potential hazards of the waste they are handling. Training of personnel and workers are the basis for an effective implementation of the waste management strategy. Raising their awareness is a way forward towards gaining their cooperation. The overall aim of the training is to develop awareness in the participants of the health, safety and environmental protection issues relating to healthcare waste, and how these can affect them in their daily work.

Overhead 13.2

All personnel should be trained on the management strategy of the establishment. Actions need to be taken at management level, of those producing the waste, and those handling the waste. Separate courses should be designed for the categories listed on the overhead, specifically adapted to their tasks, responsibilities and level of education.

Overhead 13.3

The Infection Control Officer would usually be a suitable person to be responsible for training. For smaller health-care establishments, a central training function could be established by the regional authority. Training packages could also be developed by national government agencies. A training package should include numerous illustrations, such as drawings, figure and photographs of local applications.
The ideal number of participants is 20 to 30.

Overhead 13.4

The overhead contains a number of issues to be addressed for the training of waste management operators. These are the minimal training requirements.

Overhead 13.5

These are the main areas which should be addressed in the training course. The waste may be transported by the health-care establishment, or it may contract an Aauthorized@ waste transporter.

Overhead 13.6

These are the main areas which should be addressed in the training course.
The competence of the trainee should be assessed by carrying out actual or simulated activities that have been taught in the training session to ensure that the individuals can carry out the required tasks correctly.

Overhead 13.7

ASafe burying@ of hazardous health-care waste will continue to bepracticed in many locations, until sufficient capacity for adequate treatment will be available. The training of landfill operators is important for limiting the subsequent risks, mainly related to scavenging and the quality of surface and groundwater. The competence of the trainee should be assessed.

Overhead 13.1

Aims of education and training

- To make the waste management strategy effective
- To create a competent workforce
- Highlight employees' responsibilities
- To protect employees health and safety

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Overhead 13.2

Target groups for training
(health-care establishments)

- Hospital managers and waste managers
- Medical doctors
- Nursing staff
- Hospital cleaners, porters and auxiliary staff

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Overhead 13.3

Training programme content

Training should be competence based with hands-on training in simulated real life situations, on the following subjects:

- Health-care waste policy with full justification
- Instructions on individual responsibilities
- Detailed technical instructions on procedures to be followed

Periodical repetition courses will refreshen and update the knowledge

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Overhead 13.4

Training for waste management operators

- Information on risks, and health and safety advice
- Competence based training on all handling procedures, including the management of incidents
- Wearing of protective clothing
- Use of safety equipment
- Documentation and record keeping

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Overhead 13.5

Training for waste transporters

- Risks related to the transported waste
- Handling, loading and unloading procedures
- Procedures for dealing with spillages
- Wearing of protective clothing
- Equipment of the vehicle
- Documentation and record-keeping procedures
  (e.g. consignment note system)

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Overhead 13.6

Training for operators of waste treatment facilities

- Outline of the operation of the facility
- Health and safety related to the operations
- Emergency procedures
- Technical procedures
- Maintenance and record keeping
- Emission control
- Surveillance of residue quality

World Health Organization

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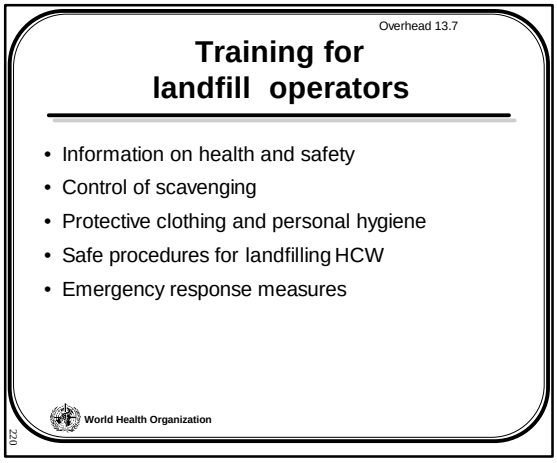
Reduced overheads - Lecture 13



3.19 Workshop 5
Regulatory package/ Waste management plan - design

Two groups should be established for this workshop. Participants from authorities may mainly join the group A, and participants from health-care establishments group B. It may however be enriching if group A also contains participants from group B and vice versa.

A) Draft an outline of a regulatory package for national legislation on health-care waste management

Draft the structure of the national regulatory package (e.g. policy, law, guidelines); draft the main elements to be included in the regulatory documents.

B) Design a comprehensive waste management plan for a large hospital, and one for a smaller, remote establishment, taking into account the following aspects:

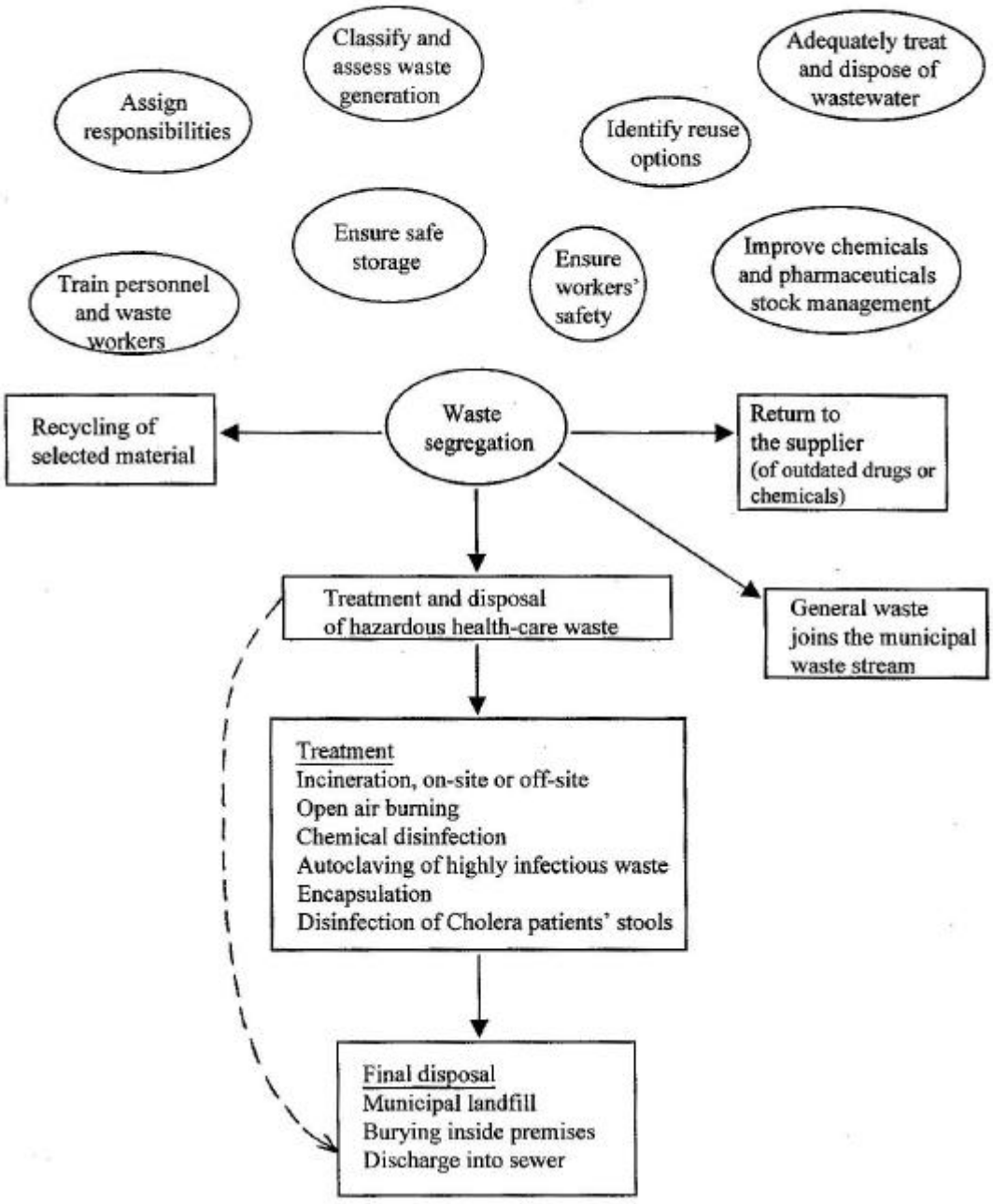
- Organization and responsibilities
- On-site waste management
- Waste treatment and disposal
- Wastewater management
- Workers= health and safety
- Training

You may use the elements already elaborated during the previous workshops. An overview for an establishment practising a minimal programme for waste management, e.g. a smaller remote establishments, is provided in the Handout for Workshop 5 and may assist you in your work.

The main results of the workshops should be written on transparencies or a blackboard and reported to the entire group after about 1 hour. The results, and the compatibility between the material elaborated by the two groups, should be discussed in plenary.

Handout for Workshop 5

Basic steps in healthcare waste management in minimal programmes



3.20 Sources of handouts

Christen J/SKAT. Dares Salaam Urban Health Project. Health care waste management in district health facilities. Situational Analysis and system development. Swiss Centre for Development Cooperation in Technology and Management St Gallen, Switzerland, 1996.

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WHO. *Action Plan for the development of national programme for sound management of hospital wastes. An outcome of the Regional Consultation on Sound Management of Hospital Waste, Chiang Mai, Thailand, 28-29 November 1996.* New Delhi, India, World Health Organization, Regional Office for South-East Asia, 1997.

WHO. *Regional Guidelines for Health Care Waste Management in Developing Countries (draft)*, Working document used at the WHO Regional Workshop on Clinical Waste Management. 28 November - 2 December 1994. Kuala Lumpur, Malaysia, World Health Organization, Western Pacific Regional Environmental Health Centre (EHC), 1994.